

# Scheme of Instruction & Syllabi

Of

## Bachelor of Science (Honors)

*(Chemistry)*

(Effective from Session 2017-2018)

Department of Applied Sciences &  
Humanities

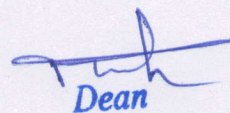
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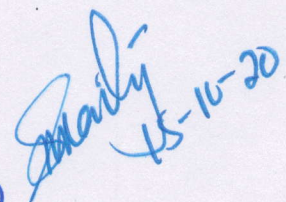
  
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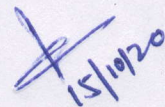


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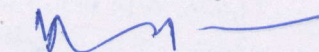
  
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## B.Sc. Honours (Chemistry)


This program provides a specialized ability to identify and solve significant problems across a broad range of application areas concerned chiefly with knowledge of Chemistry as well as of cross-discipline nature, to develop the aptitude to apply the principles of Chemistry and related sciences to articulate an in depth understanding of core knowledge on various areas of Chemical Sciences. It is designed to help students to understand the importance of role of this knowledge to contribute in improving the quality of human life. It also helps students recognize and appreciate the contribution of great scientists in the field of Physics and related fields.



B.Sc.(Hons.) Chemistry w.e.f: 2017-18

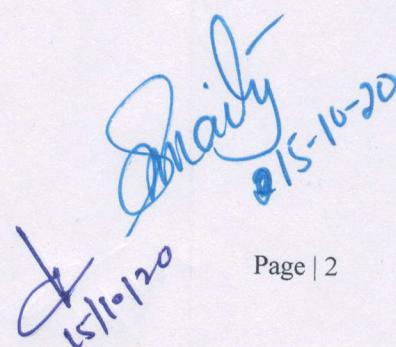


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## PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

This program acts as a specialized degree and helps to develop critical, analytical and problem solving skills at first level. This specialized degree makes the graduates employable in scientific organizations and also to assume expert administrative positions in various types of organizations. Further acquisition of higher level degrees will help the graduates to pursue a career in academics or scientific organizations as a researcher.

The Program Educational Objectives are to prepare the students to:

- PEO-1. Work independently or in team with engineering, medical, ICT professionals and scientists in scientific problem solving.
- PEO-2. Act as expert administrators in public, private and government organizations or business administrator with further training and education.
- PEO-3. Pursue masters and doctoral research degrees to work in colleges, universities as professors or as scientists in research establishments.



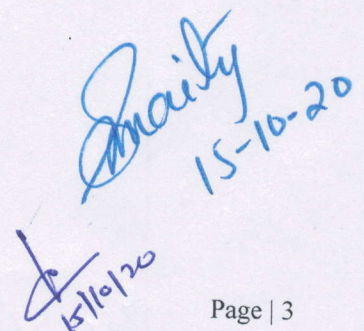
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## PROGRAM OUTCOMES (POs)

After undergoing this programme, a student will be able to execute the following successfully:

- PO-1. Scientific knowledge:** Apply the knowledge of Chemistry, Scientific fundamentals, and scientific specialization to the solution of complex scientific problems.
- PO-2. Problem analysis:** Identify, formulate, research literature, and analyze scientific problems to arrive at substantiated conclusions using first principles of Chemical sciences and nature.
- PO-3. Design/development of solutions:** Design solutions for complex scientific problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO-4. Conduct investigations of complex problems:** Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO-5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern scientific tools including prediction and modeling to complex activities with an understanding of the limitations.
- PO-6. Scientific temper and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the practice.
- PO-7. Environment and sustainability:** Understand the impact of the professional scientific solutions in societal and environmental

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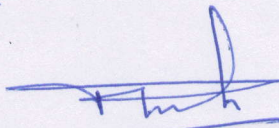
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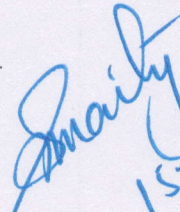
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contexts, and demonstrate the knowledge of, and need for sustainable development.

- PO-8.** **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the work practice.
- PO-9.** **Individual and team work**: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
- PO-10.** **Communication**: Communicate effectively with their community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.
- PO-11.** **Project management and finance**: Demonstrate knowledge and understanding of scientific and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.
- PO-12.** **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning and research in the broadest context of scientific & technological change.

  
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## B.Sc. (Honors)-Chemistry

### Scheme of Instruction

(Effective from session 2017-2018)

I Year										
I Semester			Teaching Scheme			Marks Distribution			Credits	
PAPER	CODE	SUBJECT	L	T	P	ESM	MSM	Total		
Paper 1	BHM101	Matrix & Calculus	3	1	0	70	30	100	4	
Paper 2	BHM102	Numerical & Statistical Techniques	3	1	0	70	30	100	4	
Paper 3	BHP101	Mechanics	3	1	0	70	30	100	4	
Paper 4	BHP102	Optics	3	1	0	70	30	100	4	
Paper 5	BHC101	Inorganic Chemistry-I	3	1	0	70	30	100	4	
Paper 6	BHC102	Organic Chemistry-I	3	1	0	70	30	100	4	
Lab 1	BHM151	Lab Work-I	0	0	2	35	15	50	2	
Lab 2	BHP 151	Physics Lab I	0	0	2	35	15	50	2	
Lab 3	BHC151	Chemistry Lab-I	0	0	2	35	15	50	2	
<b>Total</b>			<b>18</b>	<b>6</b>	<b>6</b>	<b>525</b>	<b>225</b>	<b>750</b>	<b>30</b>	

II Semester										
PAPER	CODE	SUBJECT	L	T	P	ESM	MSM	Total	Credits	
Paper 1	BHM201	Vector Calculus	3	1	0	70	30	100	4	
Paper 2	BHM202	Analytical Geometry	3	1	0	70	30	100	4	
Paper 3	BHP201	Properties of matter	3	1	0	70	30	100	4	
Paper 4	BHP202	Waves and Oscillations	3	1	0	70	30	100	4	
Paper 5	BHC201	Physical Chemistry-I	3	1	0	70	30	100	4	
Paper 6	BHC202	Inorganic Chemistry-II	3	1	0	70	30	100	4	
Lab 1	BHM251	Lab Work-II	0	0	2	35	15	50	2	
Lab 2	BHP251	Physics Lab II	0	0	2	35	15	50	2	
Lab 3	BHC251	Chemistry Lab-II	0	0	2	35	15	50	2	
<b>Total</b>			<b>18</b>	<b>6</b>	<b>6</b>	<b>525</b>	<b>225</b>	<b>750</b>	<b>30</b>	

L – Lecture

T – Tutorial

P – Practical

ESM – End Semester Mark

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**B.Sc. (Honors)-Chemistry**  
**Scheme of Instruction**  
(Effective from session 2017-2018)

II Year										
III Semester			Teaching Scheme			Marks Distribution			Credits	
PAPER	CODE	SUBJECT	L	T	P	ESM	MSM	Total		
Paper 1	BHM301	Differential equations	3	1	0	70	30	100	4	
Paper 2	BHM302	Statics & Dynamics	3	1	0	70	30	100	4	
Paper 3	BHP301	Electricity and Magnetism	3	1	0	70	30	100	4	
Paper 4	BHP302	Semiconductor Physics	3	1	0	70	30	100	4	
Paper 5	BHC301	Organic Chemistry-II	3	1	0	70	30	100	4	
Paper 6	BHC302	Physical Chemistry-II	3	1	0	70	30	100	4	
Lab 1	BHM351	Lab Work-III	0	0	2	35	15	50	2	
Lab 2	BHP351	Physics Lab III	0	0	2	35	15	50	2	
Lab 3	BHC351	Chemistry Lab-III	0	0	2	35	15	50	2	
<b>Total</b>			<b>18</b>	<b>6</b>	<b>6</b>	<b>525</b>	<b>225</b>	<b>750</b>	<b>30</b>	
IV Semester										
PAPER	CODE	SUBJECT	L	T	P	ESM	MSM	Total	Credits	
Paper 1	BHM401	Elementary Algebra & Analysis	3	1	0	70	30	100	4	
Paper 2	BHM402	Integral Transform	3	1	0	70	30	100	4	
Paper 3	BHP401	Thermal Physics	3	1	0	70	30	100	4	
Paper 4	BHP402	Electronic devices & circuits	3	1	0	70	30	100	4	
Paper 5	BHC401	Inorganic Chemistry-III	3	1	0	70	30	100	4	
Paper 6	BHC402	Organic Chemistry-III	3	1	0	70	30	100	4	
Lab 1	BHM451	Lab Work-IV	0	0	2	35	15	50	2	
Lab 2	BHP451	Physics Lab IV	0	0	2	35	15	50	2	
Lab 3	BHC451	Chemistry Lab-IV	0	0	2	35	15	50	2	
<b>Total</b>			<b>18</b>	<b>6</b>	<b>6</b>	<b>525</b>	<b>225</b>	<b>750</b>	<b>30</b>	

L – Lecture  
T – Tutorial  
P – Practical  
ESM – End Semester Marks

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**B.Sc. (Honors)-Chemistry**  
**Scheme of Instruction**  
(Effective from session 2017-2018)

III Year										
V Semester			Teaching Scheme			Marks Distribution			Credits	
PAPER	CODE	SUBJECT	L	T	P	ESM	MSM	Total		
Paper 1	BHC501	Inorganic Chemistry-IV	3	1	0	70	30	100	4	
Paper 2	BHC502	Organic Chemistry-IV	3	1	0	70	30	100	4	
Paper 3	BHC503	Physical Chemistry-III	3	1	0	70	30	100	4	
Paper 4	BHC504	Biochemistry and Environmental Chemistry	3	1	0	70	30	100	4	
Paper 5	BHC551	Inorganic & Organic Chemistry Lab	0	0	4	35	15	50	2	
Lab 5	BHC552	Physical & Biochemistry and Environmental Chemistry Lab	0	0	4	35	15	50	2	
<b>Total</b>			<b>12</b>	<b>5</b>	<b>8</b>	<b>350</b>	<b>150</b>	<b>500</b>	<b>20</b>	
VI Semester										
PAPER	CODE	SUBJECT	L	T	P	ESM	MSM	Total	Credits	
Paper 1	BHC601	Inorganic Chemistry-V	3	1	0	70	30	100	4	
Paper 2	BHC602	Organic Chemistry-V	3	1	0	70	30	100	4	
Paper 3	BHC603	Physical Chemistry-IV	3	1	0	70	30	100	4	
Paper 4	BHC604	Application of Computers in Chemistry	2	1	0	35	15	50	2	
Paper 5	BHC605	Environmental Science	2	0	0	35	15	50	2	
Lab 1	BHC651	Inorganic & Organic Chemistry Lab	0	0	4	35	15	50	2	
Lab 3	BHC652	Physical Chemistry & Applications of Computers in Chemistry Lab	0	0	2	35	15	50	2	
<b>Total</b>			<b>13</b>	<b>4</b>	<b>6</b>	<b>350</b>	<b>150</b>	<b>500</b>	<b>18</b>	

L – Lecture  
T – Tutorial  
P – Practical  
ESM – End Semester Marks

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*Dr. D. Arumugam*  
**Dean**

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**(Dr. D. Arumugam)**





## SEMESTER I

BHM101: Matrix & Calculus	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

### Course Objectives:

1. To work with matrices and determine if a given square matrix is invertible.
2. To solve systems of linear equations and application problems requiring them.
3. To compute determinants and know their properties.
4. To find and use eigen values and eigenvectors of a matrix.
5. To introduce the basic tools of calculus and geometric properties of different conic sections which are helpful in understanding their applications in planetary motion, design of telescope and to the real-world problems.

### Detailed Syllabus

<b>Unit-1</b> <b>Matrices:</b> Elementary row and column transformation, Rank of matrix, Linear dependence, Consistency of linear system of equations and their solution, Characteristic equation, Caley-Hamilton theorem, Eigen values and eigen vectors, Diagonalisation, Complex and unitary matrices, Application of matrices to engineering problems.
<b>Unit-2</b> <b>Differential Calculus-I:</b> Leibnitz theorem, Partial differentiation, Eulers theorem, Curve tracing, Change of variables, Expansion of function of several variables.
<b>Unit-3</b> <b>Differential Calculus-II:</b> Jacobian, approximation of errors, Extrema of functions of several variables, Lagranges method of multipliers (Simple applications).
<b>Text Books:-</b> 1. H.K.Dass, Higher Engineering Mathematics, S.Chand Publications. 2. B.S.Grewal, Engineering Mathematics, Khanna Publishers, 2004. <b>Reference Books:-</b> 1. R.K.Jain & S.R.K.Iyenger, Advance Engineering Mathematics, Narosa Publishing House, 2002. 2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005. 3. E.Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2005. 4. C.Ray Wylie & Louis C. Barrett, Advanced Engineering Mathematics, Tata Mc Graw-Hill Publishing Company Ltd. 2003 5. Peter V. O'Neil, Advanced Engineering Mathematics, Thomson (Cengage) Learning, 2007. 5. Peter V. O'Neil, "Advanced Engineering Mathematics", Thomson (Cengage) Learning, 2007.

### **Course Outcomes:**

After completing the course, students will be able to:

1. Find the inverse of a square matrix.
2. Solve the matrix equation  $Ax = b$  using row operations and matrix operations.
3. Find the determinant of a product of square matrices, of the transpose of a square matrix, and of the inverse of an invertible matrix
4. Find the characteristic equation, eigen values and corresponding eigenvectors of a given matrix.
5. Determine if a given matrix is diagonalizable.
6. Sketch curves in a plane using its mathematical properties in the different ordinate systems of reference.
7. Apply derivatives in Optimization, Social sciences, Physics and Life sciences etc.

<b>BHM102: Numerical &amp; Statistical Techniques</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

**Course Objectives:**

1. To comprehend various computational techniques to find approximate value for possible root(s) of non-algebraic equations, to find the approximate solutions of system of linear equations and ordinary differential equations.
2. To make the students familiar with the basic statistical concepts and tools which are needed to study situations involving uncertainty or randomness.
3. To render the students to several examples and exercises that blend their everyday experiences with their scientific interests.

**Detailed Syllabus**

<b>Unit-1</b> Numerical Techniques – I Zeroes of transcendental and polynomial equation using Bisection method, Regula-falsi method and Newton-Raphson method, Rate of convergence of above methods. Interpolation: Finite differences, difference tables, Newton’s forward and backward interpolation , Lagrange’s and Newton’s divided difference formula for unequal intervals.
<b>Unit-2</b> Numerical Techniques –II Solution of system of linear equations, Gauss- Seidal method, Crout method. Numerical differentiation, Numerical integration , Trapezoidal , Simpson’s one third and three-eight rules, Solution of ordinary differential (first order, second order and simultaneous) equations by Euler’s, Picard’s and forth-order Runge-Kutta mehthods.
<b>Unit-3</b> Statistical Techniques - I Moments, Moment generating functions, Skewness, Kurtosis, Curve fitting, Method of least squares, Fitting of straight lines, Polynomials, Exponential curves etc., Correlation, Linear, non –linear and multiple regression analysis, Probability theory.
<b>Unit-4</b> Statistical Techniques - II Binomial, Poisson and Normal distributions, Sampling theory (small and large), Tests of significations, Chi-square test, t-test.
<b>Text Books:-</b> 1. H.K.Dass, Higher Engineering Mathmatics, S.Chand Publications. 2. B.S.Grewal, Engineering Mathematics, Khanna Publishers, 2004. <b>Reference Books:-</b> 1. R.K.Jain & S.R.K.Iyenger, Advance Engineering Mathematics, Narosa Publishing House, 2002. 2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005. 3. E.Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2005. 4. C.Ray Wylie & Louis C. Barrett, Advanced Engineering Mathematics, Tata Mc Graw-Hill Publishing Company Ltd. 2003 5. Peter V. O’Neil, Advanced Engineering Mathematics, Thomson (Cengage) Learning,2007. 5. Peter V. O’Neil, “Advanced Engineering Mathematics”, Thomson (Cengage) Learning, 2007.

### **Course Outcomes:**

After completing the course, students will be able to:

1. Apply some numerical methods to find the zeroes of nonlinear functions of a single variable and solution of a system of linear equations, up to a certain given level of precision.
2. Interpolation techniques to compute the values for a tabulated function at points not in the table.
3. Understand the applications of numerical differentiation and integration to convert differential equations into difference equations for numerical solutions.
4. study the joint behavior of two random variables.
5. establish a formulation helping to predict one variable in terms of the other, i.e., correlation and linear regression.
6. Solve an algebraic or transcendental equation using an appropriate numerical method.
7. Solve a linear system of equations using an appropriate numerical method.
8. Perform an error analysis for a given numerical method.

<b>BHP101: Mechanics</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

### Course Objectives:

1. To understand the fundamentals of physics like Linear Momentum, Rotational Dynamics, Motion under Central Forces, Properties of Matter etc.
2. It gives an in-depth understanding of specialist bodies of knowledge within the engineering discipline

### Detailed Syllabus

<b>Unit-1</b> Fundamentals of dynamics Dynamics of a system of particles, Centre of mass, conservation of momentum, idea of conservation of momentum from Newton's third law, impulse, and momentum of variable mass system: motion of rocket
<b>Unit-2</b> Work and Energy Work and kinetic energy theorem, conservative and nonconservative forces, potential energy, energy diagram, stable and unstable equilibrium, gravitational potential energy, force as gradient of potential energy, work and potential energy, work done by nonconservative forces, law of conservation of energy
<b>Unit-3</b> Rotational dynamics Angular momentum of a particle and system of particles, torque, conservation of angular momentum, rotation about a fixed axis, moment of inertia, theorems of moment of inertia, calculation of moment of inertia for one dimensional bar, rectangular lamina, disc, cylindrical rod, spherical shell & solid sphere, kinetic energy of rotation, motion along an inclined plane involving both translation and rotation
<b>Unit-4</b> Gravitation Law of gravitation, inertial and gravitational mass, potential and field due to spherical shell and solid sphere, orbital velocity and escape velocity
<b>Text Book:</b> 1. Daniel Kleppner, Robert J. Kolenkow, <i>An introduction to mechanics</i> , McGraw-Hill, 1973 2. F W Sears, M W Zemansky and H D Young, <i>University Physics</i> , Narosa Publishing House, 1982 3. David Halliday, Robert Resnick Jearl Walker <i>Principles of Physics</i> , 10ed, ISV Paperback – 2015
<b>Reference Books:</b> 1. Charles Kittel, Walter Knight, Malvin Ruderman, Carl Helmholtz, Burton Moyer, <i>Mechanics Berkeley physics course, Vol.1:</i> Tata McGraw-Hill, 2007 2. Keith R. Symon, <i>Mechanics</i> , Addison Wesley; 3 edition, 1971 3. D. S. Mathur, <i>Mechanics</i> , (S. Chand & Company Limited, 2000)

### **Course Outcomes:**

After completing the course, students will be able to:

- 1.** Define conservative, non-conservative forces, work, potential energy, impulse, torque, moment of inertia, angular momentum, law of gravitation.
- 2.** Understand dynamics of system of particles, idea of conservation of momentum from Newton's third law, orbital and escape velocity.
- 3.** Calculate moment of inertia for one dimensional bar, rectangular lamina, cylindrical rod, spherical shell and solid sphere, potential and field due to spherical shell and solid sphere
- 4.** Analyse the motion along an inclined plane involving both translation and rotation, and rotation about a fixed axis.
- 5.** Evaluate work done by non-conservative forces, momentum of variable mass system.
- 6.** Create potential energy diagram with stable and unstable equilibrium.

<b>BHP102: Optics</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

**Course Objectives:**

1. To understand the fundamental of ray optics and geometrical optics.
2. To understand the fundamentals of physics like interference of light, diffraction, Polarization.

**Detailed Syllabus**

<b>Unit-1</b> Geometrical optics Introduction of ray optics, Sign conventions, General theory of image formation, Cardinal points, Newton's formula, Equivalent focal length of combination of two thin lenses
<b>Unit-2</b> Interference Theory of interference, Conditions for sustained interference, Division of amplitude and division of wavefront, Young's double slit experiment, Fresnel's biprism, Phase change on reflection: Stoke's treatment, Interference in thin films: parallel and wedge-shaped films, Newton's rings: measurement of wavelength and refractive index Michelson's interferometer.
<b>Unit-3</b> Fraunhofer diffraction Introduction of diffraction, Types of diffraction, Difference between interference and diffraction, Diffraction due to (i) a single slit, (ii) a double slit and (iii) N-slit or a plane transmission grating
<b>Unit-4</b> Resolving power Introduction, Resolving power, Rayleigh's criterion, Limit of resolution of Eye, Limit of resolution of a convex lens, Resolving power of optical instruments, Lord Rayleigh Criterion for resolution, Resolving power of a grating
<b>UNIT 5</b> Polarization Introduction of polarized light, Polarization by reflection & refraction, Brewster's law, Malus's law, Phenomena of double refraction, Uniaxial & biaxial crystals, Ordinary & extraordinary ray, Quarter wave plate & Half wave plate, Analysis of plane, Circular and Elliptical polarized light, Optical activity, Fresnel's theory of optical activity, Specific rotation, Polarimeter.
<b>Text Books:</b> 1. Francis Arthur Jenkins and Harvey Elliott White, Fundamentals of Optics McGraw-Hill, 1976 2. Eugene Hecht and A. R. Ganesan, Optics, Pearson Education, 2002 3. Brijlal & Subhramanyam, Optics, S. Chand Publications, 2011
<b>Reference Books:</b> 1. Abdul Al-Azzawi, Light and Optics: Principles and Practices, CRC Press, 2007 A. K. Ghatak & K. Thyagarajan, Contemporary Optics, Plenum Press, 1978



**Course Outcomes:**

After completing the course, students will be able to:

1. Recognize and classify different characteristics of light; such as reflection, refraction transmission and dispersion etc.
2. Understand the techniques for the demonstration of dual nature; particle and wave nature of light.
3. Apply the different experimental methods of light interference, diffraction and polarization phenomenon for the determination of light wavelength, film thickness, refractive index etc.
4. Analyse the behaviour of positive and negative crystals in view of ordinary and extraordinary rays. To analyse the behaviour of plane polarized, elliptically polarized and circularly polarized light.
5. Evaluate the specific rotation of optically active sugar solutions using saccharimeter.
6. Design and fabricate simple optical set-ups for obtaining coherent extended sources, for interference.

<b>BHC101: Inorganic Chemistry-I</b>	
<p><b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4</p>	<p><b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks I Semester Exam – 70 marks</p>

**Course Objectives:**

1. To give an overview of complete knowledge of atomic structure.
2. To describe the solid state and theories of bonding.
3. To explain periodic table and general properties.
4. To explain the atomic radii.
5. To explain about hydrogen and water treatment.

**Detailed Syllabus**

<p><b>Unit-1</b> Atomic Structure Wave mechanics: de Broglie equation, Heisenberg's uncertainty principle and its significance, Schrodinger's wave equation, significance of <math>\psi</math> and <math>\psi^2</math>. Quantum numbers, Shapes of <i>s</i>, <i>p</i>, <i>d</i> and <i>f</i> orbitals. Pauli's exclusion principle, Hund's rule of maximum multiplicity, Aufbau's principle.</p>
<p><b>Unit-2</b> Solids State Solids and their classification, unit cells, Close packing, Radius ratio rule and crystal coordination number. Chemical bonding, hydrogen bonding, Theories of bonding in metals (Free electron, VB &amp; Band theory).</p>
<p><b>Unit-3</b> Periodicity of Elements Position of elements (<i>s</i>, <i>p</i>, <i>d</i> &amp; <i>f</i> block) in the periodic table and general properties related to their electronic structures. Detailed discussion of the following properties of the elements, with reference to <i>s</i> &amp; <i>p</i> block. (a) Effective nuclear charge, shielding or screening effects, variation of effective nuclear charge in periodic table. (b) Atomic radii (Vander Waals, Ionic &amp; Covalent radii) (c) Ionization enthalpy and factors affecting ionization energy. (e) Electronegativity, Pauling's/ Mullikan's/ Electronegativity scales</p>
<p><b>Unit-4</b> Hydrogen and water treatment Chemistry of Hydrogen, Hydrogen peroxide including manufacturing and structure, Heavy Hydrogen, Heavy water, ortho and Para Hydrogen. Hardness of water, removal &amp; estimation of hardness. Zeolite method and ion exchange method for removing hardness of water.</p>

**Text and Reference Books**

1. *Basic Inorganic Chemistry*, F.A Cotton, G. Wilkinson, and Paul L. Gauss, 3rd Edition (1995), John Wiley & Sons, New York.
2. *Concise Inorganic Chemistry*, J.D. Lee, 5th Edition (1996), Chapman & Hall, London.

**Course Outcomes:**

After completing the course, students will be able to:

- 1 Describe the Hund multiplicity, Pauli exclusion principles and Aufbau principle.
- 2 Summarize the Band theory, Valence bond theory, Effective Nuclear Charge, atomic radii, ionisation enthalpy, and electro negativity.
- 3 Solve the problems based on quantum numbers, hardness of water.
- 4 Differentiate among the localized and delocalized chemical bond, radical and angular wave functions, ideal and non-ideal gases.

<b>BHC102: Organic Chemistry-I</b>	
<p><b>Teaching Scheme</b>            Lectures: 3 hrs/Week            Tutorials: 1 hr/Week              Credits: 4</p>	<p><b>Examination Scheme</b>            Class Test -12Marks            Teachers Assessment - 6Marks            Attendance – 12 Marks            I Semester Exam – 70 marks</p>

**Course Objectives:**

1. To give an overview of complete knowledge of classification and nomenclature of Organic compounds.
2. To describe the electronic Displacements.
3. To explain different types of reactions.
4. To explain the stereochemistry of compounds.
5. To explain about hydrocarbons and named reaction.

**Detailed Syllabus**

<p><b>Unit-1</b>            General Organic Chemistry            Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules.            Electronic Displacements: Inductive, Electromeric, Resonance effects and Hyperconjugation. Homolytic and Heterolytic fission. Electrophiles and Nucleophiles.            Introduction of organic reactions : Addition, Elimination and Substitution reactions.</p>
<p><b>Unit-2</b>            Stereochemistry            Fischer Projection, Newmann and Sawhorse Projection formulae, Element of symmetry, Atropisomerism, Chirality-optical activity, Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations. Relative and absolute configurations: D/L and R/S nomenclatures.            An introduction to Spectroscopy.</p>
<p><b>Unit-3</b>            Hydrocarbons and name reactions            Chemistry of alkanes: Formation of alkanes, Aldol condensation, canizzaro reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation.</p>
<p><b>Unit-4</b>            Unsaturated Hydrocarbons            Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, reactions. Saytzeff eliminations. Reactions of alkenes: Electrophilic additions, their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of hydroboration-oxidation, ozonolysis, reduction (catalytic and chemical).</p>

### **Unit-5**

Aromatic Hydrocarbons

Aromaticity: Huckel's rule, aromatic character of arenes, cyclic carbocations / carbanions and

heterocyclic compounds. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation. Directing effects of the groups.

### **Text and Reference Books**

1. *Organic Chemistry*, I. L. Finar , Vol. I, 6th Edition (1973), ELBS and Longman Ltd., New Delhi.
2. *Organic Chemistry*, R. T. Morrison and R. N. Boyd, 6th Edition (1992), Prentice-Hall of India (P) Ltd., New Delhi.
3. *Organic Chemistry*, Paula Y. Bruice , 2nd Edition, Prentice-Hall, International Edition (1998).

\* Latest editions of all the suggested books are recommended.

### **Course Outcomes:**

After completing the course, students will be able to :

1. Define inductive, mesomeric, electromeric and resonance effects. Homolytic and Heterolytic Bond fission. Electrophiles and nucleophiles.
2. Summarize types of hybridisation, halogenations, nitration, sulphonation and Friedel-Craft's alkylation/acylation.
3. Determine the formation of alkenes and alkynes by elimination reactions .
4. Compare different types of reaction intermediates and their stability.
5. Judge the stereochemistry of compounds using Fischer's, Newmann and Sawhorse Projections.
6. Hypothesize geometrical isomerism on the basis of cis-trans and syn-anti isomerism.

<b>BHM151: Lab Work I</b>	
<b>Teaching Scheme</b> Lectures: 2 hrs/Week  Credits: 2	<b>Examination Scheme</b> External marks- 35 Internal marks- 15

#### **Course Objectives:**

1. To create and control simple plot and user-interface graphics objects in MATLAB.
2. To familiar with memory and file management in MATLAB.
3. To design simple algorithms to solve problems
4. To understand the MATLAB environment
5. To get basic knowledge about simple numerical computations and analyses using MATLAB.

#### **Detailed Syllabus**

Modeling of the following problems using *Matlab/ Mathematica/ Maple* etc.

- (i) Plotting of graphs of function  $e^{ax+b}$ ,  $\log(ax+b)$ ,  $1/(ax+b)$ ,  $\sin(ax+b)$ ,  $\cos(ax+b)$ ,  $|ax+b|$  and be able to find the effect of  $a$  and  $b$  on the graph.
- (ii) Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.
- (iii) Any one of the following
  - (a) Sketching parametric curves (Eg. Trochoid, cycloid, epicycloids, hypocycloid)
  - (b) Obtaining surface of revolution of curves
  - (c) Tracing of conics in Cartesian coordinates/ polar coordinates
  - (d) Sketching ellipsoid, hyperboloid of one and two sheets, elliptic cone, elliptic

#### **Course Outcomes:**

After completing the course, students will be able to:

1. Perform computations on scalars and multidimensional arrays from MATLAB command window.
2. Use commands to retrieve data from the user or from input files into the workspace.
3. Create MATLAB functions that perform required tasks based on specified data inputs and outputs.
4. Write MATLAB programs that perform required repetition involving un-nested and nested while and for loops.
5. Generate plots and export this for use in reports and presentations.

<b>Physics Lab-I : BHP151</b>	
<b>Teaching Scheme</b>  Practical : 2 hr/week  Credits: 2	<b>Examination Scheme</b>  Attendance - 5 Marks Teachers Assessment – 10 Marks  End Semester Exam – 35 marks

Prerequisite: - Handling of scales, weights and measures, idea of Least count and vernier scales, average or means of data, error analysis, practice in making simple measurements with vernier devices, idea of types of errors in measurement and methods to minimize them.

#### **Course Objectives:**

1. To give an overview of the experiment equipment and underlying principles.
2. To give complete knowledge of handling of instrument and making correct measurements
3. To describe the method of making calculations and plotting graphs & interpret them.
- 4 To explain the various possible causes of error and their removal.
5. To organize the result and make further use in understanding and problem solving.
6. To create new experimental setups for related extended and advanced measurements.

#### **Detailed Syllabus**

<p><b>Student has to perform any eight experiments;</b></p> <ol style="list-style-type: none"> <li>1. To determine the height of a tower with a sextant.</li> <li>2. To determine the wavelength of monochromatic light by Newton's ring.</li> <li>3. To determine the focal length of two lenses by nodal slide and locate the position of cardinal points.</li> <li>4. To determine the Moment of Inertia of a Flywheel.</li> <li>5. To determine the coefficient of viscosity of water by capillary flow method (Poiseuille's method).</li> <li>6. To determine the surface tension of a liquid by Jager's method.</li> <li>7. To determine the modulus of rigidity by horizontal apparatus.</li> <li>8. To determine the modulus of rigidity by vertical apparatus.</li> <li>9. To determine g by Bar Pendulum.</li> <li>10. To determine g by Katter's Pendulum.</li> </ol>
<p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. GeetaSanon, B. Sc. Practical Physics, 1<sup>st</sup>Edn. (2007), R. Chand &amp; Co</li> <li>2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi</li> <li>3. Indu Prakash and Ramakrishna, A Text Book of Practical Physics Vol 1 &amp; Vol 2, KitabMahal, New Delhi</li> <li>4. D. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi</li> </ol>

**Course Outcomes:**

After completing the course, students will be able to:

1. Make correct measurements using laboratory instruments
2. Align and setup the instrument for performing the experiment.
3. Diagnose any errors in arrangement
4. Analyze the observations by calculating the related physical quantities.
5. Evaluate the percentage and maximum probable error.
6. Minimize the sources of error and designing additional related experiments



<b>BHC151: Chemistry Lab -I</b>	
<b>Teaching Scheme</b> Practicals: 2 hrs/Week Credits: 2	<b>Examination Scheme</b> External marks- 35 Internal marks- 15

**Course Objectives:**

1. To give an overview of Acid- Base Titrations.
2. To explain Oxidation- Reduction Titrimetry.

**Detailed Syllabus**

<b>Unit-1</b> (A) Acid- Base Titrations (i) Estimation of carbonate and hydroxide present together in mixture. (ii) Estimation of carbonate and bicarbonate present together in a mixture. (ii) Estimation of free alkali present in different soaps/detergents.
<b>Unit-2</b> (B) Oxidation- Reduction Titrimetry (i) Estimation of Fe(II) and oxalic acid using standardized $\text{KMnO}_4$ solution. (ii) Estimation of oxalic acid and sodium oxalate in a given mixture. (iii) Estimation of Fe (II) with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal (diphenylamine, anthranilic acid) and external indicator.

**Course Outcomes:**

After completing the course, students will be able to:

<ol style="list-style-type: none"> <li>1. Understand various types of Estimation of anions.</li> <li>2. Identify Oxidation- Reduction Titrimetry.</li> </ol>
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## SEMESTER II

<b>BHM 201: Vector Calculus</b>	
<p><b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4</p>	<p><b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks</p>

### Course Objectives:

1. To define vector fields.
2. To calculate line integrals along piecewise smooth paths; interpret such quantities as work done by a force .
3. To use the fundamental theorem of line integrals.
4. To use Green’s theorem to evaluate line integrals along simple closed contours on the plane.
5. To compute the curl and the divergence of vector fields.
6. To apply Stokes’ theorem to compute line integrals along the boundary of a surface.
7. To use Stokes’ theorem to give a physical interpretation of the curl of a vector field.
8. To use the divergence theorem to give a physical interpretation of the divergence of a vector field.

### Detailed Syllabus

<p><b>Unit-1</b> Vector Differential Calculus: Vector differentiation. Velocity, Acceleration of a particle moving on a space curve. Point function, Gradient, divergence and curl of a vector and their physical interpretations.</p>
<p><b>Unit-2</b> Multiple Integrals: Double and triple integral, Change of order, Change of variables, Beta and Gamma functions, Application to area, volume, Dirichlet integral and its applications.</p>
<p><b>Unit-3</b> Vector Integral Calculus: Line, surface and volume integrals, Statement and problems of Green’s, Stoke’s and Gauss divergence theorems (without proof).</p>
<p><b>Text and Reference Books</b></p> <ol style="list-style-type: none"> <li>1. H.K.Dass, Higher Engineering Mathematics, S.Chand Publications.</li> <li>2. B.S.Grewal, Engineering Mathematics, Khanna Publishers, 2004.</li> <li>3. R.K.Jain &amp; S.R.K.Iyenger, Advance Engineering Mathematics, Narosa Publishing House, 2002.</li> <li>4. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.</li> <li>5. E.Kreyszig, Advanced Engineering Mathematics, John Wiley &amp; Sons, 2005.</li> <li>6. C.Ray Wylie &amp; Louis C. Barrett, Advanced Engineering Mathematics, Tata Mc Graw-Hill Publishing Company Ltd. 2003</li> <li>7. Peter V. O’Neil, Advanced Engineering Mathematics, Thomson (Cengage) Learning,2007.</li> <li>8. Peter V. O’Neil, “Advanced Engineering Mathematics”, Thomson (Cengage)</li> </ol>

Learning, 2007.

**Course Outcomes:**

After completing the course, students will be able to:

1. Memorize definition of directional derivative and gradient and illustrate geometric meanings with the aid of sketches.
2. Memorize theorem relating directional derivative to gradient and reproduce proof.
3. Calculate directional derivatives and gradients.
4. Apply gradient to solve problems involving normal vectors to level surfaces.
5. Explain the concept of a vector integration a plane and in space.
6. Establish Inter-relationship amongst the line integral, double and triple integral formulations.
7. Apply the applications of multi variable calculus tools in physics, economics, optimization, and understanding the architecture of curves and surfaces in plane and space etc.

<b>BHM202- Analytical Geometry</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

#### **Course Objectives:**

1. To get basic knowledge about Circle, Cone, Parabola, Hyperbola, Ellipse etc.
2. To understand the concepts & advance topics related to two & three dimensional geometry.
3. To study the applications of conics.
4. To study the application of Sphere, cone and cylinder.
5. To study how to trace the curve.

#### **Detailed Syllabus**

General equation of second degree, Tracing of conics, System of conics, Confocal conics, Polar equation of a conic and its properties. Three dimensional system of co-ordinates, Projection and direction cosines, Plane, Straight line. Sphere, cone and cylinder. Central conicoids, Reduction of general equation of second degree, Tangent plane and normal to a conicoid, Pole and polar, Conjugate diameters, Generating lines, Plane sections.

#### **Text and Reference Books**

1. P. N. Pandey: Polar Coordinate Geometry, Sharda Academic Publishing House, Allahabad.
2. MataAmbar Tiwari and R. S. Sengar: A course in Vector Analysis and its Applications.
3. P.K.Jain A Textbook Of Analytical Geometry Of Three Dimensions New Age International
4. S.L. Loney, The Elements of Coordinate Geometry, Macmillan and Company, London
5. Gorakh Prasad and H.C.Gupta : Text Book on Coordinate Geometry, Pothishala Pvt. Ltd., Allahabad.

#### **Course Outcomes:**

After completing the course, students will be able to:

1. Understand geometrical terminology for angles, triangles, quadrilaterals and circles.
2. Measure angles using a protractor.
3. Use geometrical results to determine unknown angles.
4. Recognize line and rotational symmetries.
5. Find the areas of triangles, quadrilaterals and circles and shapes based on these.

<b>BHP201: Properties of Matter</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

### Course Objectives:

1. To understand the general properties of matter including elasticity, bending of beams etc.
2. To develop the basic understanding by solving problems based on fluids both in rest and in motion.

### Detailed Syllabus

<b>Unit-1</b> <b>Elasticity</b> Hooke's law, stress-strain diagram, elastic moduli, relation between elastic constants, poisson's ratio-expression for poisson's ratio in terms of elastic constants, work done in stretching and work done in twisting a wire, twisting couple on a cylinder, determination of rigidity modulus by static torsion, torsional pendulum, determination of rigidity modulus and moment of inertia, determination of $Y$ , $\eta$ and $\sigma$ by searle's method
<b>Unit-2</b> <b>Bending of beams</b> Bending of beams, expression for bending moment, cantilever, expression for depression at the loaded end, oscillations of a cantilever, expression for time period, determination of young's modulus by cantilever oscillations non-uniform bending, determination of young's modulus by koenig's method, uniform bending, expression for elevation, experiment to determine young's modulus using pin and microscope method
<b>Unit-3</b> <b>Surface tension</b> Synclastic and anticlastic surface, excess of pressure, application to spherical and cylindrical drops and bubbles, variation of surface tension with temperature, Jaegar's method
<b>Unit-4</b> <b>Viscosity</b> Stream line and turbulent flow of fluids, ideal fluids, equation of continuity, rate flow of liquid in a capillary tube, Poiseuille's formula for flow of a liquid through a capillary tube, determination of coefficient of viscosity of a liquid in laboratory
<b>Text Book:</b> 1. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill 2. D. S. Mathur, Mechanics, (S. Chand & Company Limited, 2000)
<b>Reference Books:</b> 1. Properties of matter by Murugesan R, S. Chand & Co. Pvt. Ltd., New Delhi 2. Properties of matter by Brij Lal & Subramaniam, N Eurasia publishing Co., New Delhi, 1989

**Course Outcomes:**

After completing the course, students will be able to:

- 1.To understand , stress-strain diagram, elastic moduli, moment of inertia ,  $Y$ ,  $\eta$  and  $\sigma$  by searle's method differential equation of SHM and its solution, electrical damped harmonic oscillator: LCR circuit, forced electrical oscillation
- 2.To calculate , mathematical formulation, differential equation of forced harmonic oscillator, sharpness of resonance, differential equation of SHM and its solution, relation between elastic constants, poisson's ratio-expression for poisson's ratio in terms of elastic constants,
- 3.To analyse work done in stretching and work done in twisting a wire determination of rigidity modulus, free oscillations of systems with one degree of freedom: (i) mass-spring system
- 4.To create simple pendulum, torsional pendulum, stress-strain diagram, twisting couple on a cylinder, torsional pendulum

<b>BHP202: Waves and Oscillations</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

### Course Objectives:

It helps to understand and describe simple harmonic motion (SHM), be able to derive the equations of motions for physical systems that undergo SHM .

### Detailed Syllabus

<b>Unit-1 Wave Motion</b> Plane and spherical waves, longitudinal and transverse waves, plane progressive (travelling) waves, wave equation, particle and wave velocities, differential equation, pressure of a longitudinal wave energy transport, intensity of wave
<b>Unit-2 Velocity of waves</b> Velocity of longitudinal waves in a fluid in a pipe, Newton's formula for velocity of sound, laplace's correction, effect of various factors on velocity of sound, shock waves
<b>Unit-3 Free oscillations</b> SHM: Simple harmonic oscillations, differential equation of SHM and its solution, amplitude, frequency, time period and phase, velocity and acceleration. kinetic, potential and total energy and their time average values, free oscillations of systems with one degree of freedom: (i) mass-spring system, (ii) simple pendulum, (iii) torsional pendulum (iv) electrical oscillator (LC circuit)
<b>Unit-4 Damped oscillations</b> Damper harmonic oscillator, mathematical formulation, power dissipation, relaxation time, quality factor, electrical damped harmonic oscillator: LCR circuit
<b>Unit-5 Forced oscillations</b> Introduction, transient and steady states, amplitude, phase, resonance, differential equation of forced harmonic oscillator, sharpness of resonance, power dissipation, band-width and quality factor, forced electrical oscillation.

**Text Books:**

1. K. Uno Ingard, Fundamentals of Waves & Oscillations, (Cambridge University Press, 1988)
2. Daniel Kleppner, Robert J. Kolenkow, An Introduction to Mechanics, (McGraw-Hill, 1973)

**Reference Books:**

1. A. P. French, Vibrations and Waves, (CBS Pub. & Dist., 1987)
2. N. K. Bajaj, The Physics of Waves and Oscillations, (Tata McGraw-Hill, 1988)
3. Franks Crawford, Waves: BERKELEY PHYSICS COURSE (SIE), (Tata Mc Graw Hill, 2007).
4. N. Subrahmanyam & Brijlal, Waves & Oscillation, (S. Chand Publications, 2010)

**Course Outcomes:**

After completing the course, students will be able to:

1. Understand physical characteristics of SHM and obtaining solution of the oscillator using differential equations
2. Solve wave equation and understand significance of transverse waves
3. Solve for the solutions and describe the behavior of a damped and driven harmonic oscillator in both time and frequency domains
4. Gain knowledge on applications of transverse and longitudinal waves.
5. Obtain boundary conditions of a longitudinal vibration in bars free at one end and also fixed at both the ends



<b>BHC201: Physical Chemistry-I</b>	
<p><b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4</p>	<p><b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks II Semester Exam – 70 marks</p>

### Course Objectives:

1. To give an overview of complete knowledge of kinetic theory of gases.
2. To describe the Viscosity of liquids, experimental determination of viscosity coefficient.
3. To explain different types colloids and their characteristic properties.
4. To explain about thermodynamics and its laws.
5. To explain about gels, micelles and emulsions.

### Detailed Syllabus

<p><b>Unit-1</b> Gaseous state Kinetic theory of gases, ideal gas laws based on kinetic theory. Behaviour of real gases-the van der Waal's equation. Critical phenomena-critical constants of a gas and their determination.</p>
<p><b>Unit-2</b> Liquid State Surface tension of liquids-capillary action, experimental determination of surface tension, temperature effect on surface tension. Viscosity of liquids, experimental determination of viscosity coefficient, its variation with temperature.</p>
<p><b>Unit-3</b> Thermodynamics First law of thermodynamics and their applications, thermodynamic system, states and processes work, heat and internal energy, zeroth law of thermodynamics, various types of work done on a system in reversible and irreversible process, Calorimetry and thermochemistry, enthalpy changes in various physical and chemical process, second law of thermodynamics and its applications.</p>
<p><b>Unit-4</b> Colloidal chemistry Colloids, the colloidal state, preparation and purification of colloids and their characteristic properties, lyophilic and lyophobic colloids and coagulation, protection of colloids, gels, emulsions, micelles surfactants and their classification.</p>

**Text and Reference Books**

1. *Physical Chemistry*: P. C. Rakshit, 5th Edition (1988), 4th Reprint (1997), Sarat Book House, Calcutta.
2. *Physical Chemistry*: B. R. Puri, L. R. Sharma, and M. S. Pathania. 37th Edition (1998), Shoban Lal Nagin Chand & Co., Jalandhar.
3. *Physical Chemistry*: P. Atkins and J. De Paul, 8th Edition (2006), International Student Edition, Oxford University Press.

\* Latest editions of all the suggested books are recommended

**Course Outcomes:**

After completing the course, students will be able to:

1. State that kinetic theory of gases.
2. Explain the Collision in a gas-mean free path.
3. Briefly describe experimental determination of viscosity coefficient.
4. Determine the enthalpy changes in various physical and chemical process.
5. Classify the nonradioactive and chemical pathways.
6. Define lyophilic and lyophobic colloids and coagulation, protection of colloids, gels, emulsions, surfactants and micelles.

<b>BHC202: Inorganic Chemistry-II</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks II Semester Exam – 70 marks

**Course Objectives:**

1. To give an overview of chemical bonding.
2. To describe the electronic configuration of s,p and d blocks.
3. To explain hybridization and various theories of bonding.
4. To explain the weak Chemical forces.
5. To explain acids and bases.

**Detailed Syllabus**

<b>Unit-1</b> Chemistry of s and p-block and d-block elements Alkali and alkaline earth metals and their general properties, general characteristics of p-block elements and d-block elements.
<b>Unit-2</b> Chemical Bonding Ionic bond: General characteristics, types of ions, size effects, radius ratio rule and its limitations. Packing of ions in crystals. Madelung constant, Born-Haber cycle and its application, Solvation energy.
<b>Unit-3</b> Hybridization and various theories of bonding Lewis structure, Valence Bond theory (Heitler-London approach). Energetics of hybridization. Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules (CO, NO) and homonuclear diatomic molecules, VSPER theory and its applications.
<b>Unit-4</b> Weak Chemical forces Van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Hydrogen bonding
<b>Unit-5</b> Acids and Bases Bronsted- Lowry concept of acid-base reaction, solvated proton, relative strength of acids, types of acid-base reactions, leveling solvents, Lewis acid-base concept, Classification of Lewis acids, Hard and Soft Acids and Bases (HSAB), Application of HSAB principle.

**Text and Reference Books**

1. *Inorganic Chemistry*, Huhey, J.E. Prentice Hall 1993
2. *Concepts & Models of Inorganic Chemistry*, Douglas, B.E. and Mc Daniel, D.H., Oxford 1970
3. *Concise Inorganic Chemistry*, Lee, J.D., ELBS (1991)
4. *Inorganic Chemistry*, Shriver & Atkins, Third Edition, Oxford Press 1994.
5. *Inorganic Chemistry*, H.W. Porterfield, Second Edition, Academic Press, 2005

**Course Outcomes:**

After completing the course, students will be able to:

1. Explain the general characteristics of s, p-block elements and d-block elements.
2. Explain the hybridization in different molecules.
3. Explain the molecular orbital diagrams of diatomic and simple polyatomic molecules (CO, NO).
4. Determine the types of chemical forces.
5. Classify the acids and bases.
6. Define HSAB principle.

<b>BHM251: Lab Work II</b>	
<b>Teaching Scheme</b> Lectures: 2 hrs/Week  Credits: 2	<b>Examination Scheme</b>  External marks- 35 Internal marks- 15

### Course Objectives:

1. To create and control simple plot and user-interface graphics objects in MATLAB.
2. To familiar with memory and file management in MATLAB.
3. To design simple algorithms to solve problems
4. To understand the MATLAB environment
5. To get basic knowledge about simple numerical computations and analyses using MATLAB.

### Detailed Syllabus

<p>Modeling of the following problems using <i>Matlab/ Mathematica/ Maple</i> etc.</p> <p>(i) Any one of the following</p> <ol style="list-style-type: none"> <li>(a) To find numbers between two real numbers.</li> <li>(b) Plotting subsets of <math>R</math> to study boundedness/unboundedness and bounds (if they exist).</li> <li>(c) Plotting of sets on <math>R</math> to discuss the idea of cluster points, <math>\lim \sup</math>, <math>\lim \inf</math>.</li> </ol> <p>(ii) Any one of the following</p> <ol style="list-style-type: none"> <li>(a) Plotting of recursive sequences.</li> <li>(b) Study the convergence of sequences through plotting.</li> <li>(c) Verify Bolzano Weirstrass theorem through plotting of sequences and</li> <li>(d) Studying the convergence /divergence of infinite series by plotting their sequences of partial sum.</li> </ol> <p>(iii) Any one of the following</p> <ol style="list-style-type: none"> <li>(a) Cauchy's root test by plotting <math>n^{\text{th}}</math> roots</li> <li>(b) Ratio test by plotting the ratio of <math>n^{\text{th}}</math> and <math>n+1^{\text{th}}</math> term.</li> </ol> <p>(vi) Matrix operation (addition, multiplication, inverse, transpose)</p>
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### Course Outcomes:

After completing the course, students will be able to:

<ol style="list-style-type: none"> <li>1. Perform computations on scalars and multidimensional arrays from MATLAB command window.</li> <li>2. Use commands to retrieve data from the user or from input files into the workspace.</li> <li>3. Create MATLAB functions that perform required tasks based on specified data inputs and outputs.</li> <li>4. Write MATLAB programs that perform required repetition involving un-nested and nested while and for loops.</li> <li>5. Generate plots and export this for use in reports and presentations.</li> </ol>
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<b>Physics Lab-II : BHP251</b>	
<b>Teaching Scheme</b>  Practical : 2 hr/week  Credits: 2	<b>Examination Scheme</b>  Attendance - 5 Marks Teachers Assessment – 10 Marks  End Semester Exam – 35 marks

### Course Objective's

- To introduce the proper methods for conducting controlled physics experiments, including the acquisition, analysis and physical interpretation of data.
- Illustrate the principles of modern physics.
- Perform experiments and interpret the results of observation, including making an assessment of experimental uncertainties.

### Detailed Syllabus

**Student has to perform any eight experiments;**

1. To determine the Young's Modulus of material by bending of beam method.
2. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
3. To determine the Elastic Constants of a Wire by Searle's method.
4. To determine the coefficient of viscosity of water by capillary flow method (Poiseuille's method).
5. To determine the surface tension of a liquid by Jager's method.
6. To determine the modulus of rigidity by horizontal apparatus.
7. To determine the modulus of rigidity by vertical apparatus.
8. To determine g by Bar Pendulum.
9. To determine g by Katter's Pendulum.
10. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of g, and (c) Modulus of Rigidity
11. To determine the Frequency of an Electrically Maintained Tuning Fork by Melde's Experiment.

**Reference Books:**

1. Geeta Sanon, BSc Practical Physics, 1<sup>st</sup> Edn. (2007), R. Chand & Co
2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi.

3. Indu Prakash and Ramakrishna, A Text Book of Practical Physics Vol. 1 & Vol. 2, Kitab Mahal, New Delhi.
4. D. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.

**Course Outcomes:**

After completing the course, students will be able to:

1. Make correct measurements using laboratory instruments
2. Align and setup the instrument for performing the experiment.
3. Diagnose any errors in arrangement
4. Analyze the observations by calculating the related physical quantities.
5. Evaluate the percentage and maximum probable error.
6. Minimize the sources of error and designing additional related experiments

<b>BHC251: Chemistry Lab -II</b>	
<b>Teaching Scheme</b> Practicals: 2 hrs/Week Credits: 2	<b>Examination Scheme</b> External marks- 35 Internal marks- 15

**Course Objectives:**

1. To explain the viscosity.
2. To describe partition coefficient.
3. To explain the pH.
4. To explain the hardness of water.
5. To explain about conductivity.

**Detailed Syllabus**

<ol style="list-style-type: none"> <li>1. To determine the viscosity of a given liquid at room temperature by using Ostwald's viscometer.</li> <li>2. To study partition coefficient of iodine between carbon tetrachloride and water.</li> <li>3. Determination of pH of a given solution using glass electrode.</li> <li>4. Determination of conductivity of solvents.</li> <li>5. Determination of hardness of water using EDTA.</li> <li>6. To find out the rate constant for the inversion of cane sugar in acidic medium and to show that inversion follows the first order kinetics.</li> </ol>
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**Course Outcomes:**

After completing the course, students will be able to:

<ol style="list-style-type: none"> <li>1. Determine viscosity of a given liquid.</li> <li>2. Analyze the study of partition coefficient.</li> <li>3. Identify the meaning of conductivity.</li> <li>4. Understand hardness of water.</li> <li>5. Find out the rate constant for the inversion of cane sugar.</li> </ol>
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### SEMESTER III

<b>BHM301: Differential Equation</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

#### Course Objectives:

1. To evaluate first order differential equations including separable, homogeneous, exact, and linear.
2. To solve second order and higher order linear differential equations.
3. To solve differential equations using variation of parameters.
4. To solve linear systems of ordinary differential equations
5. To introduce students to partial differential equations.
6. To introduce students to how to solve linear Partial Differential with different methods.
7. To derive heat and wave equations in 2D and 3D.

#### Detailed Syllabus

<b>Unit-1</b> Differential Equations Linear differential equations of nth order with constant coefficients, Complementary functions and particular integrals, Simultaneous linear differential equations, Solutions of second order differential equations by changing dependent and independent variables, Method of variation of parameters, Applications to engineering problems (without derivation).
<b>Unit-2</b> Series Solutions and Special Functions: Series solutions of ODE of 2nd order with variable coefficients with special emphasis to differential equations of Legendre, and Bessel Legendre polynomials, Bessels functions and their properties.
<b>Unit-3</b> Partial Differential Equations Introduction of partial differential equations, Linear partial differential equations with constant coefficients of 2nd order and their classifications - parabolic, elliptic and hyperbolic with illustrative examples.
<b>Unit-4</b> Applications of Partial Differential Equations Method of separation of variables for solving partial differential equations, Wave and Heat equations in one dimension. Laplace equation.
<b>Text Books:-</b> 1. H.K.Dass, Higher Engineering Mathematics, S.Chand Publications. 2. B.S.Grewal, Engineering Mathematics, Khanna Publishers, 2004.
<b>Reference Books:-</b>

1. R.K.Jain & S.R.K.Iyenger, Advance Engineering Mathematics, Narosa Publishing House, 2002.
2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.
3. E.Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.
4. C.Ray Wylie & Louis C. Barrett, Advanced Engineering Mathematics, Tata Mc Graw-Hill Publishing Company Ltd. 2003
5. Peter V. O'Neil, Advanced Engineering Mathematics, Thomson (Cengage) Learning, 2007. 5. Peter V. O'Neil, "Advanced Engineering Mathematics", Thomson (Cengage) Learning, 2007.

### **Course Outcomes:**

After completing the course, students will be able to:

1. Solve first order differential equations utilizing the standard techniques for separable, exact, linear, homogeneous cases.
2. Find the complete solution of a non homogeneous differential equation as a linear combination of the complementary function and a particular solution.
3. Complete solution of a non homogeneous differential equation with constant coefficients by the method of undetermined coefficients.
4. Find the complete solution of a differential equation with constant coefficients by variation of parameters.
5. Understand the working knowledge of basic application problems described by second order linear differential equations with constant coefficients.
6. Solve linear partial differential equations of both first and second order .
7. Apply partial derivative equation techniques to predict the behavior of certain phenomena.

<b>BHM302: Statics &amp; Dynamics</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

### Course Objectives:

1. To develop an understanding of the principles of statics
2. To develop an ability to analyze problems in a systematic and logical manner, including the ability to draw free-body diagrams.
3. To analyze the statics of trusses, frames and machine.
4. To apply laws of statics.
5. To know the knowledge of equilibrium conditions of a static body.
6. To develop an understanding of the principles of dynamics.
7. To develop an ability to analyze problems in a systematic and logical manner, including the ability to draw free-body diagrams of rigid body.
8. To analyze the dynamics of rigid body.
9. To discuss the motion on smooth and rough planes.
10. To discuss general motion of rigid body, Keplers laws.

### Detailed Syllabus

<b>Unit-1</b> <b>Statics:</b> Analytic condition of equilibrium for coplanar forces. Equation of the resultant force. Common catenary, Centre of gravity, Virtual work. Wrenches, Null line and null plane.
<b>Unit-2</b> <b>Dynamics:</b> Rotation of a vector in a plane. Radial and transverse velocity & acceleration, Tangential and Normal velocity and acceleration. Simple harmonic motion, Motion under other laws of forces, Earth attraction, Motion in resisting medium. Central orbits and Motion of a particle in the dimensions Kepler's laws of motion.

### Text Books:-

1. R.S. Verma - A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad.
2. S.L. Loney - An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies, Kalyani Publishers, New Delhi.
3. J.L. Synge & B.A. Griffith - Principles of Mechanics, Tata McGraw-Hill, 1959.

### Course Outcomes:

After completing the course, students will be able to:

1. Construct free-body diagrams and to calculate the reactions necessary to ensure static equilibrium.
2. Develop an understanding of the analysis of distributed loads.
3. Develop knowledge of internal forces and moments in members.
4. Calculate centroids and moments of inertia.
5. Construct free-body diagrams.
6. Develop an understanding of the analysis of distributed loads.
7. Understand internal forces and moments in members.
8. Apply Keplers laws to solve the problems.

<b>BHP301: Electricity and Magnetism</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

### Course Objectives:

1. To provide a detailed and through knowledge of basic concept of electricity and magnetism.
2. Helps to know the definition of an electric field, and understand the difference between the electric field and electric force.

### Detailed Syllabus

<b>Unit-1</b> <b>Electric Field</b>  Electric field and lines, electric field due to a ring of charge, electric flux, gauss's law, gauss's law in differential form, applications of gauss's law: E due to (i) an infinite line of charge, (ii) a charged cylindrical conductor, (iii) an infinite sheet of charge and two parallel charged sheets, (iv) a charged spherical shell, (v) a charged hollow sphere, (vi) a uniformly charged solid sphere, electrostatic energy.
<b>Unit-2</b> <b>Electric Potential</b>  Line integral of electric field, electric potential difference and electric potential V (line integral), conservative nature of electrostatic field, relation between E and V, electrostatic potential energy of a system of charges, potential and electric field of (i) a charged wire and (ii) a charged disc
<b>Unit-3</b> <b>Magnetic Field</b>  Magnetic field (B), magnetic force between current elements and definition of B, magnetic flux, Biot- savart's law: B due to (i) a straight current carrying conductor and (ii) current loop, Ampere's circuital law (integral and differential forms): B due to (i) a solenoid and (ii) a toroid
<b>Unit-4</b> <b>Magnetic Properties</b>  Magnetism of matter: gauss's law of magnetism (integral and differential forms), magnetization current, relative permeability of a material, magnetic susceptibility, magnetization vector (M), magnetic intensity (H), relation between B, M and H. stored magnetic energy in matter, magnetic circuit. B-H curve and energy loss in hysteresis

**Unit-5**

**Electromagnetic induction**

Faraday's law (differential and integral forms), Lenz's law, self and mutual induction, energy stored in a magnetic field

**Text Books:**

1. Edward M. Purcell, Electricity and Magnetism, (McGraw-Hill Education, 1986)
2. David J. Griffiths, Introduction to Electrodynamics, 3<sup>rd</sup> Edn, (Benjamin Cummings, 1998).

**Reference Books:**

1. Arthur F. Kip, Fundamentals of Electricity and Magnetism, (McGraw-Hill, 1968)
2. J. H. Fewkes & John Yarwood, Electricity and Magnetism, Vol.-I (Oxford Univ. Press, 1991).
3. D. C. Tayal, Electricity and Magnetism. (Himalaya Publishing House, 1988).

**Course Outcomes:**

After completing the course, students will be able to:

1. To define or describe electric and magnetic field and also electric potential
2. To understand the different laws in electric (Gauss's law and applications) and magnetic field (Biot and Savart's laws, Ampere's law)
3. To apply the different laws of Magnetic field (Biot and Savart's, Ampere's law) for magnetic field due to current carrying coil, Solenoid Toroid.
4. To analyse the behaviour External magnetic field on the magnetic material and also the Hysteresis Loop
5. To Evaluate numerical problems and theorems of electric field and magnetic field
6. To Classify the possible differences among Paramagnetic materials Dia magnetic material, Ferromagnetic materials. Magnetisation.

<b>BHP302: Semiconductor Physics</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

### Course Objectives:

The aim of the course is to develop physics and engineering strategies of semiconductor materials and to discuss their functionalities in modern electronic devices.

### Detailed Syllabus

<b>Unit-1</b> <b>Basics of semiconductors</b>  Energy bands in solids, valence and conduction bands, Insulators, conductors and semiconductors, Types of semiconductors: Extrinsic & intrinsic semiconductors, Fermi level, majority and minority carriers, conductivity of intrinsic and extrinsic semiconductors, p and n type semiconductors, idea about drift and diffusion
<b>Unit-2</b> <b>P-N junction</b>  Formation of depletion layer, barrier formation in P-N junction diode, junction or barrier potential, energy band diagram of p-n junction, recombination, drift and saturation of drift velocity, biasing of P-N junction: forward and reverse
<b>Unit-3</b> <b>P-N junction diode</b>  Junction resistance, junction breakdown, junction capacitance, equivalent circuit of P-N junction, basic idea about diode fabrication, the ideal diode, the real diode, Basic idea about different types of diode
<b>Unit-4</b> <b>Diode circuits</b>  Diode circuits with DC and AC voltage sources, diode clipper and clamper circuits, clippers, some clipping circuits, clampers, clamping circuits
<b>Unit-5</b> <b>Rectifiers</b>  Half wave rectifier, equivalent circuit of a half wave rectifier, full wave rectifier, equivalent circuit of a full wave rectifier, regulated and unregulated power supply, bridge rectifier.

**Text Books:**

1. Robert Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory, 8<sup>th</sup> Edition, Pearson Education, India, 2004.
2. B.L. Thareja and R.S. Sedha, Principles of Electronic Devices and Circuits, S. Chand & Company Ltd.

**Reference Books:**

1. A. P. Malvino, Electronic Principles, Glencoe, 1993.
2. John Morris, Analog Electronics.
3. Allen Mottershead, Electronic Circuits and Devices, PHI, 1997.
4. V. K. Mehta, Principals of Electronics, (S Chand & Co, New Delhi) 2010
5. N. N. Bhargava, D. C. Kulshreshtha & SC Gupta , Basic Electronics & Linear Circuits, Tata McGrawHill, 2006

**Course Outcomes:**

**After completing the course, students will be able to :**

1. Describe various properties of semiconductor materials.
2. Describe band structures of semiconductor
3. Explain the properties of n-type and p-type semiconductors.
4. To understand the current flow mechanism in p-n junction diode, rectifier diodes.
5. To define or describe the semiconductor diodes (extrinsic and intrinsic semiconductors, p-n junction diode)
6. Apply the knowledge of semiconductors to illustrate the functioning of basic electronic devices such as p-n junction, rectifiers etc.



<b>BHC301: Organic Chemistry-I</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks III Semester Exam – 70 marks

#### Course Objectives:

1. To give knowledge of halogenated hydrocarbons.
2. To describe the alcohols and phenols.
3. To explain about ethers and epoxides.
4. To explain about carbonyl compounds.
5. To describe about carboxylic acids and their derivatives.

#### Detailed Syllabus

<p><b>Unit-1</b> <b>Chemistry of Halogenated hydrocarbons:</b></p> <p>Alkyl halides, Methods of preparation, nucleophilic substitution reactions – <math>SN_1</math>, <math>SN_2</math> mechanisms. Aryl halides: Preparation, including preparation from diazonium salts. nucleophilic aromatic substitution. Organometallic compounds of Mg and Li.</p>
<p><b>Unit-2</b> <b>Alcohols and Phenols</b></p> <p>Alcohols: preparation, properties and relative reactivity of <math>1^0</math>, <math>2^0</math>, <math>3^0</math> alcohols, Preparation and properties of glycols: Oxidation by periodic acid and lead tetraacetate, Phenols: Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer – Tiemann and Kolbe's – Schmidt Reactions.</p>
<p><b>Unit-3</b> <b>Ethers and Epoxide</b></p> <p>Ethers and Epoxides: Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and <math>LiAlH_4</math>.</p>
<p><b>Unit-4</b> <b>Carbonyl Compounds</b></p> <p>Structure, reactivity and preparation; Mechanisms of Aldol and Benzoin condensation, Knoevenagel condensation, Perkin, Cannizzaro and haloform Reaction, Beckmann rearrangement.</p>

**Text and Reference Books**

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

**Course Outcomes:**

After completing the course, students will be able to:

1. Describe the basic concepts of organic functional groups.
2. Classify the alcohols, preparation, properties and relative reactivity of 1<sup>o</sup>, 2<sup>o</sup>, 3<sup>o</sup> alcohols.
3. Draw the different reaction mechanism like aldol, cannizaro and haloform etc.
4. Compare the SN2 and SN1 reactions.
5. Evaluate the reactions of epoxides with alcohols.
6. Design the synthesis of carboxylic acid and its derivatives.

<b>BHC302: Physical Chemistry-II</b>	
<p><b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4</p>	<p><b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks III Semester Exam – 70 marks</p>

**Course Objectives:**

1. To give an overview of chemical thermodynamics.
2. To describe the electrochemistry.
3. To explain the Le Chatelier principle.
4. To explain the solutions and colligative properties.
5. To explain about nuclear binding energy.

**Detailed Syllabus**

<p><b>Unit-1</b> <b>Chemical thermodynamics</b> Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics. First law: Concept of heat, q, work, w, internal energy U and statement of first law; enthalpy, H. Second Law: Concept of entropy; thermodynamic scale of temperature, statement of the second law of thermodynamics; Calculation of entropy change for reversible and irreversible processes.</p>
<p><b>Unit-2</b> <b>Electrochemistry</b> Arrhenius theory of electrolytic dissociation, Hydrolysis of salts, hydrolysis constant, buffer solutions, indicators and theory of acid-base indicators. Migration of ions: transference number and its determination by Hittorf methods.</p>
<p><b>Unit-3</b> <b>Chemical equilibrium</b> Criteria of thermodynamic equilibrium, chemical equilibria in ideal gases, concept of fugacity. Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Le Chatelier principle (quantitative treatment); equilibrium between ideal gases and a pure condensed phase.</p>
<p><b>Unit-4</b> <b>Solutions and Colligative Properties</b> Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Relative lowering of vapour pressure, Elevation of boiling point, Depression of freezing point, Osmotic pressure.</p>

**Unit-5**

**Nuclear Chemistry**

Nucleus and its classification, nuclear forces, nuclear binding energy, stability of nucleus.

Radioactivity: Radioactive elements, general characteristics of radioactive decay, decay kinetics (decay constant, half life, mean life period), units of radioactivity, nuclear fusion and fission

**Recommended Textbook:**

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press (2006).
2. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
3. Engel, T. & Reid, P. Thermodynamics, Statistical Thermodynamics, & Kinetics Pearson Education, Inc: New Delhi (2007).
4. McQuarrie, D. A. & Simon, J. D. Molecular Thermodynamics Viva Books Pvt. Ltd.: New Delhi (2004)

**Course Outcomes:**

After completing the course, students will be able to:

1. Define state and path functions.
2. Interpret Concept of entropy and thermodynamic scale of temperature.
3. Estimate transference number and its determination.
4. Analyze the outline of equilibrium between ideal gases and a pure condensed phase
5. Evaluate the Elevation of boiling point, Depression of freezing point
6. Classify the problems of Radioactive elements

<b>BHM351: Lab Work III</b>	
<b>Teaching Scheme</b> Lectures: 2 hrs/Week  Credits: 2	<b>Examination Scheme</b> External marks- 35 Internal marks- 15

### Course Objectives:

1. To create and control simple plot and user-interface graphics objects in MATLAB.
2. To familiar with memory and file management in MATLAB.
3. To design simple algorithms to solve problems
4. To understand the MATLAB environment
5. To get basic knowledge about simple numerical computations and analyses using MATLAB.

### Detailed Syllabus

Use of computer aided software (CAS), for example *Matlab/ Mathematica/ Maple/ Maxima* etc., for developing the following Numerical programs

- (i) Any two of the following
  - (a) Bisection Method
  - (b) Newton Raphson Method
  - (c) Secant Method
  - (d) RegulaFalsi Method
- (ii) LU decomposition Method
- (iii) Gauss-Jacobi Method
- (vi) SOR Method or Gauss-Siedel Method
- (v) Lagrange Interpolation or Newton Interpolation
- (vi) Simpson's rule.

### Course Outcomes:

After completing the course, students will be able to:

1. Perform computations on scalars and multidimensional arrays from MATLAB command window.
2. Use commands to retrieve data from the user or from input files into the workspace.
3. Create MATLAB functions that perform required tasks based on specified data inputs and outputs.
4. Write MATLAB programs that perform required repetition involving un-nested and nested while and for loops.
5. Generate plots and export this for use in reports and presentations.

<b>Physics Lab-III : BHP351</b>	
<b>Teaching Scheme</b>  Practical : 2 hr/week  Credits: 2	<b>Examination Scheme</b>  Attendance - 5 Marks Teachers Assessment – 10 Marks  End Semester Exam – 35 marks

**Course Objectives:**

1. To give an overview of the experiment equipment and underlying principles.
2. To give complete knowledge of handling of instrument and making correct measurements
3. To describe the method of making calculations and plotting graphs & interpret them.
4. To explain the various possible causes of error and their removal.
5. To organize the result and make further use in understanding and problem solving.
6. To create new experimental setups for related extended and advanced measurements.

**Detailed Syllabus**

**Each student has to perform any eight experiments:**

1. To determine the frequency of AC mains by Sonometer.
2. To study the response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance and (c) Quality factor Q, and (d) Band width.
3. To study the response curve of a Parallel LCR circuit and determine its (a) Anti- resonant frequency and (b) Quality factor Q.
4. To determine the specific resistance of a given wire using Carey Foster's bridge.
5. To determine a Low Resistance by a Potentiometer.
6. To calibrate the given ammeter and voltmeter by potentiometer.
7. To draw hysteresis curve of a given sample of ferromagnetic material and from - this to determine magnetic susceptibility and permeability of the given specimen
8. To determine the ballistic constant of a ballistic galvanometer.
9. To study the variation of magnetic field along the axis of current carrying - circular coil and then to estimate the radius of the coil.
10. To determine Self Inductance of a Coil by Anderson's Bridge using AC
11. To determine high resistance by leakage method.

**Reference Books:**

1. Geeta Sanon, BSc Practical Physics, 1<sup>st</sup>Edn. (2007), R. Chand & Co.
2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi.
3. Indu Prakash and Ramakrishna, A Text Book of Practical Physics Vol 1 & Vol 2, Kitab Mahal, New Delhi.
4. D. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi

**Course Outcomes:**

After completing the course, students will be able to:

1. Handle laboratory instruments and make precise measurements.
2. Align and setup the instrument for performing the experiment.
3. Diagnose any errors in arrangement
4. Analyze the observations by calculating the related physical quantities and verify the underlying law of Physics.
5. Evaluate the percentage and maximum probable error and minimizing error.
6. Design improvised extensions of related experiments.

<b>BHC351: Chemistry Lab -III</b>	
<b>Teaching Scheme</b> Practicals: 2 hrs/Week Credits: 2	<b>Examination Scheme</b> External marks- 35 Internal marks- 15

**Course Objectives:**

1. To give an overview of heat capacity and Enthalpy.
2. To explain heat capacity and solubility.

**Detailed Syllabus**

**LIST OF EXPERIMENTS**

1. Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
2. Calculation of the enthalpy of ionization of ethanoic acid.
3. Determination of heat capacity of the calorimeter and integral enthalpy (endothermic and exothermic) solution of salts.
4. Determination of enthalpy of hydration of copper sulphate.
5. Study of the solubility of benzoic acid in water and determination of  $\Delta H$ .

**Course Outcomes:**

After completing the course, students will be able to:

- |   |
|---|
| <ol style="list-style-type: none"> <li>1. Understand heat capacity and working principle of calorimeter.</li> <li>2. Analyze the reaction type and to find out the solubilities of solvents.</li> </ol> |
|---|



## SEMESTER IV

<b>BHM401: Elementary Algebra &amp; Analysis</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

### Course Objectives:

1. To work with infinite sequences and series.
2. To work with infinite sequence is bounded.
3. To work with an infinite sequence is monotonic.
4. To work with an infinite sequence is convergent or divergent.
5. To Define the real numbers, least upper bounds, and the triangle inequality.
6. To Calculate the limit superior, limit inferior, and the limit of a sequence.
7. To discuss the present the relationships between abstract algebraic structures with familiar numbers systems such as the integers and real numbers.
8. To discuss the present concepts of and the relationships between operations satisfying various properties (e.g. commutative property).
9. To discuss the present concepts and properties of various algebraic structures.
10. To discuss the importance of algebraic properties relative to working within various number systems.
11. To develop the ability to form and evaluate conjectures.

### Detailed Syllabus

<b>Unit-1</b> <b>Analysis:</b> Real Numbers and its property, Open, closed Intervals, Boundedness, Least upper bound, Greatest Lower bound, Sequence, Series, and its convergence (basic idea), Convergence of infinite series, Comparison test, ratio test, root test, Limits, continuity and differentiability (on Interval and Sets) of functions, Algebra of continuous and differentiable functions, Various mean value theorems.
<b>Unit-2</b> <b>Algebra:</b> Sets, Relations, Functions and their types, Algebraic Structure, Equivalence relations and partitions Congruence modulom relation, Algebraic Structure, Definition of a monoid, groupoid, semi group, group with examples and simple properties, Permutation groups, Subgroups, Centre and normalizer, Cyclic groups, Cosets, Lagrange's theorem. Homomorphism and isomorphism, Introduction to rings, subrings, integral domains, Division Ring and Field with examples.
<b>Text and Reference Books</b> 1. <b>Joseph A. Gallian</b> , Contemporary Abstract Algebra (4th Edition), Narosa Publishing House, New Delhi, 1999  2. <b>I. N. Herstein</b> ,Topics in Algebra, Wiley Eastern Ltd. New Delhi, 1975.  3. <b>R. G. Bartle</b> and <b>D. R. Sherbert</b> , Introduction to Real Analysis(3rd Edition), John Wiley and Sons

(Asia) Pte. Ltd., Singapore, 2002.

4. **S.C. Malik and Shanti Arora**, Mathematical Analysis, New Age Publication.

5. **Shanti Narayan**, Elements of Real Analysis, S. Chand & Company, New Delhi

**Course Outcomes:**

After completing the course, students will be able to:

1. Determine if an infinite sequence is bounded.
2. Determine if an infinite sequence is monotonic.
3. Determine if an infinite sequence is convergent or divergent.
4. Determine if an infinite series is convergent or divergent by selecting the appropriate test from the following: (a) test for divergence; (b) integral test; (c) p-series test; (d) the comparison tests; (e) ratio test; and (f) root test.
5. Describe fundamental properties of the real numbers that lead to the formal development of real analysis.
6. Demonstrate an understanding of limits and how they are used in sequences, series, differentiation and integration.
7. Understand the importance of algebraic properties with regard to working within various number systems.
8. Extend group structure to finite permutation groups.

<b>BHM402: Integral Transform</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

### Course Objectives:

1. To analyze properties of special functions by their integral representations and symmetries.
2. To determine properties of Fourier Transform which may be solved by application of special functions.
3. To determine properties of Laplace Transform which may be solved by application of special functions.
4. To determine properties of Z- Transform which may be solved by application of special functions.

### Detailed Syllabus

<b>Unit-1</b> <b>Laplace Transform:</b>  Laplace transform, Existence theorem, Laplace transform of derivatives and integrals, Inverse Laplace transform, Unit step function. Laplace transform of periodic functions, Convolution theorem, Application to solve simple linear and simultaneous differential equations.
<b>Unit-2</b> <b>Fourier Series:</b>  Periodic functions, Trigonometric series, Fourier series of period $2\delta$ , Eulers formulae, Functions having arbitrary period, Change of interval, Even and odd functions, Half range sine and cosine series.
<b>Unit-3</b> <b>Fourier &amp; Z – Transform:</b>  Introduction, Fourier integral transform, Fourier transform, properties of Fourier transform, finite Fourier transform, Fourier sine & cosine transform, Z-transform and its applications.
<b>Text Books:-</b>  1. H.K.Dass, Higher Engineering Mathematics, S.Chand Publications. 2. B.S.Grewal, Engineering Mathematics, Khanna Publishers, 2004.
<b>Reference Books:-</b>  1. R.K.Jain & S.R.K.Iyenger, Advance Engineering Mathematics, Narosa Publishing House, 2002.

2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.
3. E.Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.
4. C.Ray Wylie & Louis C. Barrett, Advanced Engineering Mathematics, Tata Mc Graw-Hill Publishing Company Ltd. 2003
5. Peter V. O'Neil, Advanced Engineering Mathematics, Thomson (Cengage) Learning, 2007.
5. Peter V. O'Neil, "Advanced Engineering Mathematics", Thomson (Cengage) Learning, 2007.

**Course Outcomes:**

After completing the course, students will be able to:

1. Understand Integral Transform and its classification.
2. Explain the applications and the usefulness of these transform.
3. Classify and explain the different types of Transforms.
4. Understand purpose and functions of the Fourier series and Transformation.

<b>BHP401: Thermal Physics</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

### Course Objectives:

1. It helps to apply the key concepts of thermal physics to a variety of thermodynamic systems such as engines, refrigerators, and the atmosphere.
2. To learn laws of thermodynamics, entropy, and Maxwell's thermodynamic relations.

### Detailed Syllabus

<p><b>Unit-1</b> <b>Zeroth and First law of thermodynamics</b></p> <p>Thermodynamical equilibrium, Zeroth law of thermodynamics and concept of temperature, Work and heat energy, State functions, First law of thermodynamics, Differential form of first law, Internal energy, First law and explanation of various thermodynamical processes, Applications of first law: general relation between <math>C_p</math> and <math>C_v</math>, Work done during isothermal and adiabatic processes.</p>
<p><b>Unit-2</b> <b>Second law of thermodynamics</b></p> <p>Reversible and irreversible changes, Conversion of work into heat and heat into work, Heat engines, Carnot cycle, Carnot engine and its efficiency, Refrigerator and its efficiency, Second law of thermodynamics: Kelvin-Planck and Clausius statements and their equivalence, Carnot theorem, Applications of second law of thermodynamics: thermodynamic scale of temperature.</p>
<p><b>Unit-3</b> <b>Entropy</b></p> <p>Concept of entropy, Change in entropy, Clausius theorem, Clausius inequality, Second law of thermodynamics in terms of entropy, Entropy of a perfect gas, Entropy of the universe, Entropy changes in reversible and irreversible processes, Principle of increase of entropy, Impossibility of attainability of absolute zero: third law of thermodynamics, Temperature-entropy diagrams.</p>
<p><b>Unit-4</b> <b>Thermodynamic potentials and Maxwell's relations</b></p> <p>Thermodynamic variables, Thermodynamic potentials <math>U</math>, <math>H</math>, <math>F</math> and <math>G</math>: their definitions, properties and applications, Derivations of maxwell's relations, Applications of maxwell's relations: (i) Clausius-Clapeyron equation, (ii) values of <math>C_p-C_v</math>, (iii) <math>TdS</math> equations, (iv) joule-thomson coefficient for ideal and vander-waal gases, (v) energy equations and (vi) change of temperature during an adiabatic</p>

process.

**Text Books:**

1. Mark Waldo Zemansky, Richard Dittman, Heat and Thermodynamics: An Intermediate Textbook (McGraw-Hill, 1981)
2. Francis W. Sears & Gerhard L. Salinger, Thermodynamics, Kinetic Theory, and Statistical Thermodynamics( Narosa, 1986).

**Reference Books:**

1. Garg, Bansal and Ghosh , Thermal Physics (Tata McGra-Hill, 1993)
2. Brijlal & Subhramanyam, Thermodynamics & Statistical Physics( S.Chand Publ.)

**Course Outcomes:**

After completing the course, students will be able to:

1. Basic concepts of Thermodynamics and first law can be understood.
2. Understanding of various thermodynamical processes and to evaluate the work done.
3. Understand the second law of thermodynamics.
4. Apply the concepts and laws of thermodynamics to solve problems in thermodynamic systems such as gases, heat engines and refrigerators etc.
5. Apply the concept of Entropy to evaluate change of entropy in different phases of matter
6. Apply the concept of thermodynamical potentials & Maxwell's equations for various therodynamical problems.

<b>BHP402: Electronic Devices &amp; Circuits</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks End Semester Exam – 70 marks

### Course Objectives:

It helps to give the ability to understand different types of electronic devices.

### Detailed Syllabus

<b>Unit-1</b> <b>Special Diodes &amp; Optoelectronic Devices:</b>  Review of P-N junction, Zener Diode & its applications, Tunnel Diode, PIN Diode, Schottky Diode, LED, Photovoltaic or Solar cell, Light activated SCR
<b>Unit-2</b> <b>Bipolar Junction Transistor:</b>  Bipolar junction transistor (PNP & NPN) & its biasing, transistor currents, CB, CE & CC configurations and bias conditions (cut off, active and saturation regions), relation between $\alpha$ & $\beta$ , transistor characteristics (Common base, emitter & collector), basics of h-parameter
<b>Unit-3</b> <b>Amplifiers:</b>  Classification of amplifiers, Various gains of CB, CE & CC amplifiers, Class A, B, and C amplifiers, introduction to multistage & feedback amplifiers
<b>Unit-4</b> <b>JFET &amp; MOSFET:</b>  Construction and working of JFET, output and transfer characteristics of FET, Determination of FET parameters, Application of FET as voltage variable resistor, Advantages of FET over BJT, <b>MOSFET:</b> construction and working of MOSFET, enhancement and depletion modes, output and transfer characteristics, Application of MOSFET as a switch
<b>Unit-5</b> <b>Oscillators:</b>  Comparison of amplifier and oscillator, Hartley & Colpitt Oscillator, RC phase shift oscillator

**Text Books:**

1. Robert Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory, 8<sup>th</sup> Edition, Pearson Education, India, 2004.
2. A. P. Malvino, Electronic Principles, Glencoe, 1993.

**Reference Books:**

1. John Morris, Analog Electronics.
2. Allen Mottershead, Electronic Circuits and Devices, PHI, 1997
3. Ben G. Streetman & Sanjay Banerjee, Solid state electronic devices, Pearson Prentice Hall, 2006.
4. N. N. Bhargava, D. C. Kulshreshtha & SC Gupta, Basic Electronics & Linear Circuits, Tata McGraw Hill, 2006
5. B.L.Thareja, R.S. Sedha, Principles of Electronic Devices and Circuits, S.Chand

**Course Outcomes:**

After completing the course, students will be able to:

1. Define or describe the semiconductor diodes(extrinsic and intrinsic semiconductors, p-n junction diode, p-n-p and n-p-n transistor, current, resistance, transistor biasing... )
2. Analyse the characteristics of transistor and transistor biasing circuits
3. Apply the different application of integrated circuits, BJT,FET etc
4. Recognize and classify different characteristics of semiconductor, junction device,FET, MOSFET,Energy
5. Obtain knowledge on oscillators, transistors and h-parameters



<b>BHC401: Inorganic Chemistry – III</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks IV Semester Exam – 70 marks

**Course Objectives:**

1. To give knowledge of s and p block elements.
2. To describe the noble gases.
3. To explain about VBT and MOT.
4. To explain about inorganic polymers.
5. To describe about silicones.

<p><b>Unit-1</b>  <b>Chemistry of s and p block elements:</b></p> <p>Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Complex formation tendency of s and p block elements. Hydrides and their classification ionic, covalent and interstitial. Basic beryllium acetate and nitrate. Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses. Boric acid and borates, boron nitrides, borohydrides (diborane) carboranes and graphitic compounds, silanes, Oxides and oxoacids of nitrogen, Phosphorus and chlorine. Peroxo acids of sulphur, interhalogen compounds, polyhalide ions, pseudohalogens and basic properties of halogens. Theoretical principles involved in volumetric analysis, done in the lab.</p>
<p><b>Unit-2</b>  <b>Noble gases :</b></p> <p>Occurrence &amp; uses, rationalization of inertness of noble gases, Clathrates; preparation and properties of XeF<sub>2</sub> and XeF<sub>4</sub>, XeF<sub>6</sub>; Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF<sub>2</sub>). Molecular shapes of noble gas compounds (VSEPR theory).</p>
<p><b>Unit-3</b>  <b>Inorganic Polymers:</b></p> <p>Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. Borazines, silicates and</p>

phosphazenes, and polysulphates.

**Text and Reference Books**

1. Greenwood, N.N. and Earnshaw, Chemistry of the Elements, Butterworth-Heinemann. 1997.
2. Lee, J.D. Concise Inorganic Chemistry, ELBS (1991).
3. Canham, G.R. and Overton, T., Descriptive Inorganic Chemistry, Freeman & Co. 2006
4. Cotton, F.A. and Wilkinson, G, Advanced Inorganic Chemistry, Wiley, VCH, 1999.

**Course Outcomes:**

After completing the course, students will be able to:

1. Explain the relative stability of different oxidation states.
2. State that hydrides and their classification ionic, covalent and interstitial.
3. Describe the oxides and oxoacids of nitrogen, Phosphorus and chlorine.
4. Preparation and properties of  $\text{XeF}_2$  and  $\text{XeF}_4$ ,  $\text{XeF}_6$ .
5. Briefly describe the types of inorganic polymers, comparison with organic polymers.
6. Explain the Borazines, silicates and phosphazenes, and polysulphates.

<b>BHC402: Organic Chemistry –III</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks IV Semester Exam – 70 marks

### Course Objectives:

1. To give knowledge of nitrogen Containing Functional Groups
2. To describe the effect of substituents and solvents on basicity.
3. To explain about polynuclear hydrocarbons.
4. To explain about classification and nomenclature of heterocyclic compounds.
5. To explain about alkaloids.

### Detailed Syllabus

<p><b>Unit-1</b>  <b>Nitrogen Containing Functional Groups</b>            Preparation and important reactions of nitro-compounds, nitriles and isonitriles            Amines: Effect of substituents and solvents on basicity; Preparation and properties: Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction; Distinction between 1<sup>o</sup>, 2<sup>o</sup> and 3<sup>o</sup> amines with Hinsberg reagent and nitrous acid;            Diazonium Salts: Preparation and their applications.</p>
<p><b>Unit-2</b>  <b>Polynuclear Hydrocarbons</b>            Reactions of naphthalene phenanthrene and anthracene Structure, Preparation and structure elucidation and important derivatives of naphthalene and anthracene; Polynuclear hydrocarbons.</p>
<p><b>Unit-3</b>  <b>Heterocyclic Compounds</b>            Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Pyrimidine, Structure elucidation of indole, Fischer indole synthesis and Madelung synthesis), Structure elucidation of quinoline and isoquinoline, Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner-Miller synthesis, Bischler-Napieralski reaction, Pictet-Spengler reaction, Pomeranz-Fritsch reaction, Derivatives of furan: Furfural and furoic acid.</p>

**Unit-4**

**Alkaloids**

Natural occurrence, General structural features, Isolation and their physiological action

Hoffmann's exhaustive methylation, Emde's modification, Structure elucidation and synthesis of Hygrine and Nicotine. Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine.

**Course outcomes:**

After completing the course, students will be able to:

1. Define or describe all concept of substituents and solvents on basicity.
2. Understand the synthesis, reactions and mechanism of substitution reactions of Furan, Pyrrole.
3. Apply the preparation and structure elucidation and important derivatives of naphthalene and anthracene.
4. Focus on natural occurrence, General structural features, Isolation and physiological action of alkaloid.
5. Judge the significance of Hoffmann's exhaustive methylation
6. Describe the medicinal importance of alkaloids.

<b>BHM451: Lab Work IV</b>	
<b>Teaching Scheme</b> Lectures: 2 hrs/Week  Credits: 2	<b>Examination Scheme</b>  External marks- 35 Internal marks- 15

**Course Objectives:**

1. To create and control simple plot and user-interface graphics objects in MATLAB.
2. To familiar with memory and file management in MATLAB.
3. To design simple algorithms to solve problems
4. To understand the MATLAB environment
5. To get basic knowledge about simple numerical computations and analyses using MATLAB.

**Detailed Syllabus**

<p>Modeling of the following problems using <i>Matlab/ Mathematica/ Maple</i> etc.</p> <p>(i) Plotting second and third order solution families</p> <p>(ii) Acceleration-velocity model</p> <p>(iii) Growth and decay model cold pill and a course of cold pills</p> <p style="padding-left: 40px;">(c) Case study of alcohol in the bloodstream (initial input/ continuous input on empty stomach and with substantial meal)</p> <p style="padding-left: 40px;">(d) Limited growth of (both exponential and logistic)</p> <p>(iv) Any two of the following</p> <p style="padding-left: 40px;">(a) Lake pollution model (with constant/ seasonal flow and pollution concentration)</p> <p style="padding-left: 40px;">(b) Case of a single population (with and without harvesting)</p> <p>(v) Any two of the following</p> <p style="padding-left: 40px;">(a) Predator prey model (basic Lotkavolterra model, with density dependence, effect of DDT, two prey one predator)</p> <p style="padding-left: 40px;">(b) Epidemic model of influenza (basic epidemic model, contagious for life, disease with carriers, disease with re-infection, density dependent contact rate)</p> <p style="padding-left: 40px;">(c) Battle model (basic battle model, jungle warfare, with desertion, long range weapons)</p> <p>(vi) Taylor and Maclaurin series of <math>\sin x</math>, <math>\cos x</math>, <math>\log(1+x)</math>, <math>e^x</math>, <math>(1+x)^n</math>, maxima and minima, inverse of graphs.</p>
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**Course Outcomes:**

After completing the course, students will be able to:

1. Perform computations on scalars and multidimensional arrays from MATLAB command window.
2. Use commands to retrieve data from the user or from input files into the workspace.
3. Create MATLAB functions that perform required tasks based on specified data inputs and outputs.
4. Write MATLAB programs that perform required repetition involving un-nested and nested while and for loops.
5. Generate plots and export this for use in reports and presentations.

<b>Physics Lab-IV : BHP451</b>	
<b>Teaching Scheme</b>  Practical : 2 hr/week  Credits: 2	<b>Examination Scheme</b>  Attendance - 5 Marks Teachers Assessment – 10 Marks  End Semester Exam – 35 marks

Prerequisite: - Handling of more advanced instruments, setting up delicate and sensitive arrangements and calibration of certain experimental setups, BPR251.

#### **Course Objectives:**

1. To give an overview of the experiment equipment and underlying principles.
2. To give complete knowledge of handling of instrument and making correct measurements
3. To describe the method of making calculations and plotting graphs & interpret them.
4. To explain the various possible causes of error and their removal.
5. To organize the result and make further use in understanding and problem solving.
6. To create new experimental setups for related extended and advanced measurements.

#### **Detailed Syllabus**

**Student has to perform any eight experiments of the following;**

- 1 To Study the FET characteristics
2. To Study the MOSFET characteristics
3. To Study the characteristics Of Photo diode.
4. To Determine the Refractive index Of Prism by using the White light
5. To Determine the Plank's constant by Photo cell
6. To study the Malus law.
7. To verify Stefan's law and to determine the value of Stefan's Constant.
8. To determine the wavelength of prominent spectral lines of mercury light by a plane transmission grating using normal incident method
  
10. To determine the coefficient of Thermal conductivity of a bad conductor by Lee and Charlton's disc method
11. To determine the coefficient of Thermal conductivity copper by Searle's Apparatus.
- 12 To determine the temperature coefficient of resistance by platinum resistance thermometer (prt).
- 13 To determine the value of mechanical equivalent of heat with joule calorimeter
- 14 To determine J By Callender and Barne's

#### **Reference books:**

1. Geeta Sanon, BSc Practical Physics, 1<sup>st</sup> Edn. (2007), R. Chand & Co
2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi.

#### **Course Outcomes:**

After completing the course, students will be able:

1. Handle laboratory instruments and make precise measurements.
2. Align and setup the instrument for performing the experiment.
3. Diagnose any errors in arrangement
4. Analyze the observations by calculating the related physical quantities and verify the underlying law of Physics.
5. Evaluate the percentage and maximum probable error and minimizing error.
6. Design improvised extensions of related experiments.



<b>BHC451: Chemistry Lab -IV</b>	
<b>Teaching Scheme</b> Practicals: 2 hrs/Week Credits: 2	<b>Examination Scheme</b> External marks- 35 Internal marks- 15

**Course Objectives:**

1. To describe complexometric Titrations.
2. To explain the Argentometry.
3. To give an overview of organic preparation and estimation.

**Detailed Syllabus**

**Sec-A:**

**(a) Complexometric Titrations:**

- (i) Complexometric estimation of (i)  $Mg^{2+}$  (ii)  $Zn^{2+}$  using EDTA
- (ii) Estimation of total hardness of water samples
- (iii) Estimation of  $Ca^{2+}$  in solution by (substitution method) using Erio-chrome black-T as indicator.
- (ii) Estimation of Ca/Mg in drugs and biological samples.

**(b) Argentometry**

Estimation of  $Cl^-$  (i) By Mohr's method, (ii) By Vohlard's method, (iii) By Fajan's method.

**(c) Paper chromatographic separation of Ni (II) and Co(II); Cu(II) and Cd (II)C**

**Sec-B:**

**Organic Preparations**

1. Diels-Alder reaction between anthracene and maleic anhydride
2. Reduction of nitrobenzene to azobenzene (TLC of the mixture) and m-dinitrobenzene to m-nitroaniline
3. Photochemical reduction of benzophenone to benzopinacol

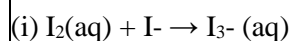
4. Benzoin condensation of benzaldehyde (using thiamine hydrochloride)
5. Condensation of p-toluidine with benzaldehyde/salicylaldehyde/2-hydroxy-3-methoxy benzaldehyde to get Schiff's base (solventless condensation)

**Estimation of:**

1. Phenol and aniline by bromination with potassium bromate-potassium bromide method
2. Glycine by formylation method
3. Saponification value of an oil/fat

**Sec – C:**

(I) Study the equilibrium of at least one of the following reactions by the distribution method:



(II) Perform the following potentiometric titrations (at least two):

(i) Strong acid with strong base (ii) weak acid with strong base and (iii) dibasic acid with strong base

(III) Potentiometric titration of Mohr's salt with potassium dichromate.

(IV) Determination of critical solution temperature and composition of the phenol-water system and to study the effect of impurities on it.

**Course Outcomes:**

After completing the course, students will be able to:

1. Understand various types of organic synthesis.
2. Analyze the effect of complexometric Titrations.
3. Identify argentometry and estimation.

## SEMESTER V

<b>BHC501:Inorganic Chemistry –IV</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks V Semester Exam – 70 marks

### Course Objectives:

1. To give an overview of coordination chemistry.
2. To give complete knowledge of octahedral vs. tetrahedral coordination.
3. To describe chemistry of Ti, V, Cr, Mn, Fe and Co.
4. To explain the difference between the first, second and third transition series.
5. To explain the lanthanides and actinides.
6. To explain the magnetic properties of lanthanides.

### Detailed Syllabus

<p><b>Unit-1</b> <b>Coordination Chemistry</b></p> <p>Werner's theory, valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, measurement of <math>10 Dq(o)</math>, CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of <math>10 Dq(o, t)</math>. Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry, Jahn-Teller theorem, square planar geometry. IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Chelate effect, polynuclear complexes.</p>
<p><b>Unit-2</b> <b>Transition elements:</b> General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. Stability of various oxidation states. Difference between the first, second and third transition series. Chemistry of Ti, V, Cr, Mn, Fe and Co in various oxidation states (excluding their</p>

metallurgy)

**Unit-3**

**Lanthanides and actinides:** electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contractions, separation of lanthanides (ion-exchange method only).

**Text and Reference Books**

1. Purecell, K.F. and Kotz, J.C., Inorganic Chemistry W.B. Saunders Co. 1977.
2. Basolo, F, and Pearson, R.C., Mechanisms of Inorganic Chemistry, John Wiley & Sons, NY, 1967.
3. Greenwood, N.N. & Earnshaw A., Chemistry of the Elements, Butterworth-Heinemann, 1997.

**Course Outcomes:**

After completing the course, students will be able to:

1. Understand various types of coordination numbers.
2. Analyze the effect of oxidation states on magnetic properties.
3. Identify stability of various oxidation states.
4. Evaluate general group trends with special reference to electronic Configuration.
5. Solve the spectral and magnetic properties.

<b>BHC502: Organic Chemistry –IV</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks V Semester Exam – 70 marks

### Course Objectives:

1. To give an overview of carbohydrates.
2. To give complete knowledge of types of carbohydrates.
3. To describe vitamins.
4. To explain the different types of nucleic acids.
5. To explain the effects of amino acids, peptides and proteins.
6. To explain the pharmaceutical compounds, lipids and terpenes.

### Detailed Syllabus

<p><b>Unit-1</b> <b>Carbohydrates</b></p> <p>Occurrence, classification and their biological importance, Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses. Disaccharides – Structure elucidation of maltose, lactose and sucrose, Polysaccharides – Elementary treatment of starch, cellulose and glycogen.</p>
<p><b>Unit-2</b> <b>Vitamins:</b></p> <p>Structure of fat soluble vitamins- A, D, E and K, Water soluble vitamins-Thiamine, Riboflavin, niacin, Cobalamine and ascorbic acid and their deficiency disorders.</p>
<p><b>Unit-3</b> <b>Nucleic Acids</b></p> <p>Components of nucleic acids, Nucleosides and nucleotides; Structure, synthesis and reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine; its application in modern life.</p>

#### **Unit-4**

##### **Amino acids, Peptides and Proteins**

Amino acids, Peptides and their classification,  $\alpha$ -Amino Acids - Synthesis, ionic properties and reactions. Zwitterions,  $pK_a$  values, isoelectric point and electrophoresis;

Study of peptides: brief introduction of 1<sup>o</sup>, 2<sup>o</sup>, 3<sup>o</sup> structures, end group analysis, methods of peptide synthesis by solution and solid phase.

#### **Unit-5**

##### **Lipids**

Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenation of fats and oils, Saponification value, acid value, iodine number.

#### **Unit-6**

##### **Pharmaceutical Compounds: Structure and Importance**

Classification, structure, synthesis and therapeutic uses of antipyretics: Paracetamol ,

Analgesics: Ibuprofen, Anti-malarials: Chloroquine. Anti-inflammatory: Aspirins

#### **Unit-7**

##### **Terpenes**

Occurrence, classification, isoprene rule; Elucidation of structure and synthesis of Citral, and  $\alpha$ -terpineol.

##### **Text and Reference Books**

1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India)

Pvt. Ltd. (Pearson Education).

2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd.

(Pearson Education).

3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry, Fourth Edition, W. H. Freeman.
5. Berg, J. M., Tymoczko, J. L. & Stryer, L. Biochemistry, Sixth Edition, W. H. Freeman.

**Course Outcomes:**

After completing the course, students will be able to:

1. Understand various types vitamins.
2. Analyze the effect of Adenine, Guanine, Cytosine, Uracil and Thymine in nucleic acid.
3. Identify oils and fats.
4. Understand classification, structure, synthesis and therapeutic uses of pharmaceutical compounds.
5. Evaluate performance, occurrence, classification, and different applications of terpenes.

<b>BHC503: Physical Chemistry –III</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks V Semester Exam – 70 marks

### Course Objectives:

1. To give an overview of conductance.
2. To give complete knowledge of types of chemical kinetics involved in reactions.
3. To describe phenomena in photochemistry.
4. To explain the different laws related to photochemistry.
5. To explain the Arrhenius theory.
6. To explain the applications of conductance measurement.

### Detailed Syllabus

<p><b>Unit-1</b> <b>Conductance</b></p> <p>Arrhenius theory of electrolytic dissociation. Conductivity, equivalent and molar conductivity, their variation with dilution for weak and strong electrolytes. Molar conductivity at infinite dilution. Kohlrausch law of independent migration of ions. Debye-Huckel-Onsager equation, Wien effect, Debye-Falkenhagen effect, Walden's rules.</p> <p>Ionic velocities, mobilities and their determinations, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and Moving Boundary methods. Applications of conductance measurement.</p>
<p><b>Unit-2</b> <b>Chemical Kinetics</b></p> <p>Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, experimental methods of the determination of rate laws, kinetics of complex reactions (integrated rate expressions up to first order only): (i) Opposing reactions (ii) parallel reactions and</p>



(iii) chain reactions.

Temperature dependence of reaction rates; Arrhenius equation; activation energy. Collision

theory of reaction rates. Surface chemistry: Physical adsorption, chemisorption, adsorption isotherms. nature of adsorbates.

Catalysis: Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces; effect of particle size and efficiency of nano particles as catalysts.

### **Unit-3**

#### **Photochemistry**

Characteristics of electromagnetic radiation, Lambert-Beer's law and its limitations, physical significance of absorption coefficient. Laws, of photochemistry, quantum yield, examples of low and high quantum yields, photochemical equilibrium and the differential rate of photochemical reactions, photosensitized reactions, quenching.

#### **Text and Reference Books**

##### **Recommended Texts:**

1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press (2006).
2. Ball, D. W. Physical Chemistry, Thomson Press, India (2007).
3. Castellan, G. W. Physical Chemistry, 4th Ed. Narosa (2004).
4. Laidler, K. J. Chemical Kinetics Pearson Education: New Delhi (2004).

#### **Course Outcomes:**

After completing the course, students will be able to:

1. Understand various types of conductance.
2. Analyze the effect of various variables on conductivity.
3. Identify chemical kinetics.
4. Understand consecutive and parallel reactions.
5. Evaluate the performance of catalysis and its different applications.
6. Understand the photosensitized reactions.
7. Analyze & Solve the performance chain reactions.

<b>BHC504: Biochemistry and Environmental Chemistry</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks V Semester Exam – 70 marks

### Course Objectives:

1. To give an overview of carbohydrates.
2. To give complete knowledge and types of proteins.
3. To describe the lipids.
4. To explain the different nucleic acid.
5. To explain the environment and its segments.
6. To describe the energy and environment.

### Detailed Syllabus

<p><b>Unit-1</b> <b>Carbohydrates</b></p> <p>Biological importance of carbohydrates, Metabolism, Cellular currency of energy (ATP), Glycolysis, Alcoholic and Lactic acid fermentations.</p> <p>Proteins: classification, biological importance; Primary, secondary and tertiary structures of proteins: <math>\alpha</math>-helix and <math>\beta</math>-pleated sheets, Denaturation of proteins</p> <p>Enzymes: Nomenclature, Characteristics, Classification; Active site, Mechanism of enzyme action.</p>
<p><b>Unit-2</b> <b>Lipids</b></p> <p>Biological importance of triglycerides and phosphoglycerides and cholesterol; Lipid membrane, Liposomes and their biological functions.</p> <p>Structure of DNA (Watson-Crick model) and RNA, Genetic Code, Biological roles of DNA and RNA.</p>

### **Unit-3**

#### **Environment and its segments**

Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur.

Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical

Smog: its constituents and photochemistry, Environmental effects of Ozone, Major sources of Air pollution, Effects of air pollution on living organisms and vegetation, Controls of air pollution, Climate change, Green house effect, global warming.

Water Pollution: Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems. Water purification methods

### **Unit-4**

#### **Energy and Environment**

Sources of energy: Coal, petrol and Natural gas. Nuclear Fusion /

Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel etc.

Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its Management.

#### **Text and Reference Books**

##### **Recommended Texts:**

1. Berg, J.M., Tymoczko, J.L. and Stryer, L. (2006) Biochemistry. VI Edition, W.H. Freeman and Co.
2. Nelson, D.L., Cox, M.M. and Lehninger, A.L. (2009), Principles of Biochemistry. IV Edition, W.H. Freeman and Co.
3. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. (2009), Harper's Illustrated Biochemistry. XXVIII edition. Lange medical Books/ McGraw-Hill

4. Manahan S.E. (2005) Environmental Chemistry, CRC Press
5. Miller, G.T. (2006) Environmental Science 11th edition. Brooks/Cole
6. Mishra, A. (2005) Environmental Studies. Selective and Scientific Books, New

**Course Outcomes:**

After completing the course, students will be able to:

1. Understand various types biological importance of carbohydrates.
2. Analyze the effect of various types of pollution.
3. Identify Nuclear Fusion /Fission.
4. Understand the biological importance of triglycerides and phosphoglycerides and cholesterol.
5. Evaluate for effects of air pollution on living organisms and vegetation.
6. Understand the sources of energy: Coal, petrol and Natural gas.
7. Analyze the nuclear Pollution.

<b>BHC551: Inorganic &amp; Organic Chemistry Lab</b>	
<b>Teaching Scheme</b> Practicals: 2 hrs/Week Credits: 2	<b>Examination Scheme</b> External marks- 35 Internal marks- 15

### Course Objectives:

1. To estimate Cu, Fe, Ni and Al.
2. To synthesize inorganic preparation.
3. To detect extra element.
4. To identify functional groups.

### Detailed Syllabus

**Sec A:**

(a) : The following quantitative estimations are to be carried out.

(i) Estimation of nickel (II) using Dimethyl lyoxime as the precipitant.

(ii) Estimation of copper as CuSCN

(iii) Estimation of iron as Fe<sub>2</sub>O<sub>3</sub> by precipitating iron as Fe(OH)<sub>3</sub> through

(1) Heterogeneous and (2) Homogeneous media.

(iv) Estimation of Al (III) by precipitating with oxine and weighing as Al(oxine)<sub>3</sub>

(aluminiumoxinate).

(b) Inorganic Preparations

(i) Tetraammine copper (II) sulphate, [Cu(NH<sub>3</sub>)<sub>4</sub>]SO<sub>4</sub> H<sub>2</sub>O

(ii) Potassium trisoxalatochromate (III), K<sub>3</sub>[Cr(C<sub>2</sub>O<sub>4</sub>)<sub>3</sub>]

(iii) Cis and trans K[Cr(C<sub>2</sub>O<sub>4</sub>)<sub>2</sub> (H<sub>2</sub>O<sub>2</sub>)] Potassium dioxalato diaquachromate(III)

(iv) Pentaamminecarbonato Cobalt (III) ion

(c) Spectrophotometric estimation of Ferrous ions by using 1,10phenanthroline

**Sec B:**

1. Systematic analysis of extra elements in the given unknown compounds
2. Qualitative analysis of the following types of unknown organic compounds
  - i. Carboxylic acids
  - ii. Phenols
  - iii. Alcohols
  - iv. Aldehydes
  - v. Ketones
  - vi. Esters

**Recommended Texts:**

1. Vogel, A.I. A text book of Quantitative Analysis, ELBS 1986.

**Course Outcomes:**

After completing the course, students will be able to:

1. Understand various types quantitative analysis.
2. Analyze the qualitative analysis.

<b>BHC552: Physical &amp; Biochemistry and Environmental Chemistry Lab</b>	
<b>Teaching Scheme</b> Practicals: 2 hrs/Week Credits: 2	<b>Examination Scheme</b> External marks- 35 Internal marks- 15

**Course Objectives:**

1. To give complete knowledge of qualitative and quantitative analysis.
2. To describe changes in conductance.
3. To explain kinetics.

**Detailed Syllabus**

<p><b>(BHC552)</b></p> <p><b>Sec-A:</b></p> <p>(I) To study changes in conductance in the following systems</p> <p>(i) Strong acid-strong base</p> <p>(ii) Weak acid-strong base and</p> <p>(iii) Mixture of strong acid and weak acid-strong base</p> <p>(II) Study the kinetics of the following reactions.</p> <p>1. Initial rate method using Iodide-persulphate reaction</p> <p>2. Integrated rate method:</p> <p>(a) Acid hydrolysis of methyl acetate with hydrochloric acid, volumetrically or conductometrically.</p> <p>(b) Iodide-persulphate reaction</p> <p>(c) Saponification of ethyl acetate.</p>
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**Sec-B:**

1. To perform quantitative estimation of protein using Lowry's method. Determine the concentration of the unknown sample using the standard curve plotted.
2. Study of the action of salivary amylase at optimum conditions
3. Effect of pH on the action of salivary amylase
4. Effect of temperature on the action of salivary amylase
5. Effect of inhibitor on the action of salivary amylase
6. Study of the activity of Trypsin using fresh tissue extracts.
7. To study the effect of temperature, organic solvents, on semi-permeable membrane.
8. Qualitative analysis of the soil from different locations for pH. Analysis of different Soluble cations and anions in water.
9. Quantitative estimation of oxidisable organic matter in soil, carbonate and bicarbonates by volumetry and calcium and magnesium by EDTA titration.
10. Hardness of water by EDTA titration
11. Study of pH and conductivity of tap and polluted water

**Course Outcomes:**

After completing the course, students will be able to:

1. Understand various types titration involves in different types of reaction.
2. Analyze the effect of pH and conductivity.



## SEMESTER VI

<b>BHC601: Inorganic Chemistry –V</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks VI Semester Exam – 70 marks

### Course Objectives:

6. To give an overview of theoretical principles and chemistry involved in qualitative analysis.
7. To describe the organometallic compounds.
8. To explain different types of metal carbonyls.
9. To explain the bioinorganic chemistry.
10. To explain about analysis of mixture of cations and anions.

<b>Unit-1</b> <b>Theoretical principles:</b>  Theoretical principles and chemistry involved in qualitative analysis of mixture of cations and anions including interfering radicals.
<b>Unit-2</b> <b>Organometallic Compounds:</b>  Definition and classification of organometallic compounds, Effective Atomic Number rule.
<b>Unit-3</b> <b>Metal carbonyls:</b>  Preparation, properties, structure and bonding of mononuclear carbonyls. $\pi$ -acceptor behaviour of carbon monoxide, synergic effect (MO diagram of CO), ferrocene and its reactions.

**Unit-4**

**Bioinorganic Chemistry:**

Metal ions present in biological systems, classification of elements according to their action in biological system. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity.

Iron and its application in bio-systems, Haemoglobin; Storage and transfer of iron.

**Text and Reference Books**

1. *Organic Chemistry*, I. L. Finar , Vol. I, 6th Edition (1973), ELBS and Longman Ltd., New Delhi.
2. *Organic Chemistry*, R. T. Morrison and R. N. Boyd, 6th Edition (1992), Prentice-Hall of India (P) Ltd., New Delhi.
3. *Organic Chemistry*, Paula Y. Bruice , 2nd Edition, Prentice-Hall, International Edition (1998).

**\* Latest editions of all the suggested books are recommended.**

**Course Outcomes:**

After completing the course, students will be able to:

1. Define organometallic compounds, Effective Atomic Number rule and carbonyl compounds.
2. Summarize the different types organometallic compounds and carbonyls.
3. Determine significance of; Storage and transfer of iron.in Haemoglobin.
4. Differentiate among atomic, ionic radii, crystal radii and covalent radii, storage and structural lipids and among non-covalent interactions,
5. Judge the significance and classification of elements according to their action in biological system.
6. Hypothesize the toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity. Iron and its application in bio-systems, Haemoglobin; Storage and transfer of iron.

<b>BHC602: Organic Chemistry-V</b>	
<p><b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4</p>	<p><b>Examination Scheme</b> Class Test -12Marks Teachers Assessment – 6 Marks Attendance – 12 Marks VI Semester Exam – 70 marks</p>

### Course Objectives:

6. To give an overview of complete knowledge of atomic structure.
7. To describe the solid state and theories of bonding.
8. To explain Molecular Spectroscopy.
9. To explain the UV Spectroscopy.
10. To explain about IR and NMR spectroscopy.
11. To explain about dyes and polymers.

<p><b>Unit-1</b> <b>Organic spectroscopy</b></p> <p>General principles Introduction to absorption and emission spectroscopy.</p> <p><b>UV Spectroscopy:</b> Types of electronic transitions, <math>\lambda_{\max}</math>, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption.</p> <p><b>IR Spectroscopy:</b> Fundamental and non-fundamental molecular vibrations. Fingerprint region and its significance; application in functional group analysis.</p> <p><b>NMR Spectroscopy:</b> Basic principles of Proton Magnetic Resonance, coupling constant chemical shift. 2D NMR( COSY and NOSY), Applications of IR, UV and NMR for identification of simple organic molecules.</p>
<p><b>Unit-2</b> <b>Dyes</b></p> <p>Classification, Colour and constitution; Mordant and Vat Dyes. Synthesis and applications of: Azo dyes – Methyl Orange and Congo Red Triphenyl Methane Dyes - Malachite Green, Rosaniline. Phthalein Dyes – Phenolphthalein and Fluorescein; Natural dyes – structure elucidation and synthesis of Alizarin and Indigotin.</p>

<p><b>Unit-3</b> <b>Polymers</b></p> <p>Introduction and classification polymers; Number average molecular weight, Weight average molecular weight, Degree of polymerization, Polydispersity Index.</p> <p>Polymerisation reactions - Addition and condensation - Mechanism of cationic, anionic and freeradical addition polymerization. Preparation and applications of plastics – thermosetting (phenol-formaldehyde) and thermosoftening (PVC, polythene);Rubbers – natural and synthetic: Buna-S, Chloroprene and Neoprene; Vulcanization; Biodegradable and conducting polymers with examples.</p>
<p><b>Text and Reference Books</b></p> <ol style="list-style-type: none"> <li>1. Kemp, W. Organic Spectroscopy, Palgrave.</li> <li>2. Kalsi, P. S. Textbook of Organic Chemistry (1st Ed.), New Age International (P) Ltd.</li> <li>3. Morrison, R. T. &amp; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt.Ltd. (Pearson Education).</li> <li>4. Billmeyer, F. W. Textbook of Polymer Science, John Wiley &amp; Sons, Inc.</li> <li>5. Gowariker, V. R., Viswanathan, N. V. &amp;Sreedhar, J. Polymer Science, New Age International (P) Ltd. Pub.</li> </ol>

**Course Outcomes:**

After completing the course, students will be able to:

<ol style="list-style-type: none"> <li>1. Define the UV,IR and NMR spectroscopy, dyes and polymers.</li> <li>2. Classify different types of dyes and polymers</li> <li>3. Summaries the Synthesis and applications of: Azo dyes – Methyl Orange and Congo Red Triphenyl Methane Dyes - Malachite Green, Rosaniline, Phthalein Dyes – Phenolphthalein.</li> <li>4. Compare the Chemistry of Ti, V, Cr, Mn, Fe and Co in various oxidation states.</li> <li>5. Standardize color and constitution of dyes .</li> <li>6. Create a model on the elucidation and synthesis of Alizarin and Indigo tin.</li> </ol>
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<b>BHC603: Physical Chemistry –IV</b>	
<p><b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4</p>	<p><b>Examination Scheme</b> Class Test -12Marks Teachers Assessment - 6Marks Attendance – 12 Marks VI Semester Exam – 70 marks</p>

### Course Objectives:

11. To give an overview Quantum Chemistry.
12. To describe the Chemical bonding.
13. To describe molecular spectroscopy.
14. To describe the Rotationl spectroscopy.
15. To explain different Nuclear Magnetic Resonance.
16. To explain the chemical shift.
17. To explain about Schrodinger equation.

<p><b>Unit-1</b> <b>Quantum Chemistry</b></p> <p>Postulates of quantum mechanics, quantum mechanical operators, Schrodinger equation. Quantization of energy levels, zero-point energy and Heisenberg Uncertainty principle; wave functions, probability distribution functions, nodal properties. Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrodinger equation and discussion of solution and wave functions. Vibrational energy of diatomic molecules and zero-point energy.</p> <p>Rigid rotator model of rotation of diatomic molecule. Schrodinger equation, transformation to spherical polar coordinates. Separation of variables. Spherical harmonics.</p>
<p><b>Unit-2</b> <b>Chemical bonding</b></p> <p>Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of <math>H_2^+</math>. Bonding and antibonding orbitals.</p> <p>Comparison of LCAO-MO and VB treatments of <math>H_2</math> (only wavefunctions, detailed solution not required) and their limitations.. Qualitative description of LCAO-MO treatment of homonuclear and heteronuclear diatomic molecules (HF, LiH).</p>

### **Unit-3**

#### **Molecular Spectroscopy:**

Rotational spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic molecules.

Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity.

Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra.

Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet States.

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, chemical shift, spin-spin coupling.

#### **Text and Reference Books**

1. Banwell, C. N. & McCash, E. M. Fundamentals of Molecular Spectroscopy 4th Ed. Tata McGraw-Hill: New Delhi (2006).
2. Chandra, A. K. Introductory Quantum Chemistry Tata McGraw-Hill (2001).
3. House, J. E. Fundamentals of Quantum Chemistry 2nd Ed. Elsevier: USA (2004).
4. Lowe, J. P. & Peterson, K. Quantum Chemistry Academic Press (2005).

### **Course Outcomes:**

After completing the course, students will be able to:

1. State that Schrodinger equation.
2. Describe the qualitative treatment of simple harmonic oscillator model of vibrational motion.
3. Derive the rigid rotator model of rotation of diatomic molecule.
4. Explain the Covalent bonding, valence bond and molecular orbital approaches.
5. Comparison of LCAO-MO and VB treatments of  $H_2$ .
6. Briefly describe the Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra.

<b>BHC604: Applications of Computers in Chemistry</b>	
<b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4	<b>Examination Scheme</b> Class Test -6 Marks Teachers Assessment - 3Marks Attendance – 6 Marks VI Semester Exam – 35 marks

### Course Objectives:

12. To give an overview of recapitulation of computer basics.
13. To describe the computer programming.
14. To explain BASIC programs for numerical differentiation and integration.
15. To explain the conceptual background of molecular modelling..
16. To explain about elementary ideas of molecular mechanics.

<p><b>Unit-1</b>  <b>Recapitulation of computer basics:</b> PC hardware, operating systems, data storage and backup, networks, information technology. Basic operations using windows.</p>
<p><b>Unit-2</b>  <b>Computer programming:</b></p> <p>Constants, variables, bits, bytes, binary and ASCII formats, arithmetic expressions, hierarchy of operations, inbuilt functions. Elements of the BASIC language. BASIC keywords and commands. Logical and relative operators. Strings and graphics. Compiled versus interpreted languages. Debugging. Simple programs using these concepts. Matrix addition and multiplication. Statistical analysis.</p> <p>BASIC programs for numerical differentiation and integration (Trapezoidal rule, Simpson's rule), finding roots (quadratic formula, iterative, Newton-Raphson method), numerical solution of differential equations.</p> <p>Conceptual background of molecular modelling: Potential energy surfaces. Elementary ideas of molecular mechanics.</p>

**Text and Reference Books**

1. Noggle, J. H. Physical chemistry on a Microcomputer. Little Brown & Co.(1985).
2. Venit, S.M. Programming in Basic: Problem solving with structure and style.Jaico Publishing House: Delhi (1996).
3. Engel, T. & Reid, P. Physical Chemistry 2nd Ed. Pearson (2010). Chapter on Computational Chemistry.

**Course Outcomes:**

After completing the course, students will be able to:

1. Describe the PC hardware.
2. Summarize the basic operations using windows.
3. Solve the problems based on matrix addition and multiplication.
4. Differentiate among the basic keywords and commands.
5. Judge the significance of logical and relative operators.
6. Describe the elementary ideas of molecular mechanics.



<b>BHC605: Environmental Science</b>	
<p><b>Teaching Scheme</b> Lectures: 3 hrs/Week Tutorials: 1 hr/Week  Credits: 4</p>	<p><b>Examination Scheme</b> Class Test -6 Marks Teachers Assessment - 3Marks Attendance – 6 Marks VI Semester Exam – 35 marks</p>

### Course Objectives:

1. To give an overview of environment.
2. To describe the sustainable development.
3. To describe Natural Resources.
4. To explain different types of conventional and non-conventional sources.
5. To explain the environmental pollution and their effects.
6. To explain about women education.

<p><b>Unit-1</b> Definition, Scope &amp; Importance, Need For Public Awareness- Environment definition, Eco system – Balanced ecosystem, Human activities – Food, Shelter, Economic and social Security. Effects of human activities on environment-Agriculture, Housing, Industry, Mining and Transportation activities, Basics of Environmental Impact Assessment. Sustainable Development</p>
<p><b>Unit-2</b> Natural Resources- Water Resources- Availability and Quality aspects, Water borne diseases, Water induced diseases, Fluoride problem in drinking water, Mineral Resources, Forest Wealth, Material cycles-Carbon, Nitrogen and Sulphur Cycles, Energy – Different types of energy, Electro-magnetic radiation, Conventional and Non-Conventional sources – Hydro Electric, Fossil Fuel based, Nuclear, Solar, Biomass and Bio-gas, Hydrogen as an alternative future source of Energy</p>
<p><b>Unit-3</b> Environmental pollution and their effects, Water pollution, Land pollution, Noise pollution, Public health aspects, Air pollution, Solid waste management, Current environmental issues of importance, Population Growth, Climate Change and Global warming-Effects, Urbanization, Automobile pollution, Acid Rain, Ozone Layer depletion, Animal Husbandry, Environmental Protection-Role of Government, Legal aspects, Initiatives by Non- governmental Organizations (NGO), Environmental Education, Women Education</p>
<p><b>Text Books:</b> 1. Benny Joseph – “Environmental Studies” –Tata McgrawHill-2005 2. Dr. D.L. Manjunath, “Environmental Studies” –Pearson Education-2006. 3. R. Rajagopalan –“Environmental studies” –Oxford Publication – 2005. 4. M. Anji Reddy – “Text book of Environmental Science &amp; Technology” –BS Publication.</p>

ReferenceBooks:

1. P. Venugoplan Rao, “Principles of Environmental Science and Engineering”–Prentice Hall of India.
2. Meenakshi, “Environmental Science and Engineering” –Prentice Hall India

**Course Outcomes:**

After completing the course, students will be able to:

1. Define Definition, Scope & Importance, Need For Public Awareness- Environment definition, Eco system – Balanced ecosystem, Human activities – Food, Shelter, Economic and social Security. Effects of human activities on environment-Agriculture, Housing, Industry, Mining and Transportation activities.
2. Summarize types of Natural Resources.
3. Water borne diseases, Water induced diseases, Fluoride problem in drinking water, Mineral Resources, Forest Wealth, Material cycles-Carbon, Nitrogen and Sulphur Cycles, Energy – Different types of energy.
4. Compare different types of environmental pollution and their effects, Water pollution, Land pollution, Noise pollution, Public health aspects, Air pollution, Solid waste management.
5. Judge current environmental issues of importance, Population Growth, Climate Change and Global warming- Effects.
6. Describe Ozone Layer depletion, Animal Husbandry, Environmental Protection-Role of Government, Legal aspects, Initiatives by Non-governmental Organizations (NGO), Environmental Education, Women Education.

<b>BHC651: Inorganic &amp; Organic Chemistry Lab</b>	
<b>Teaching Scheme</b> Practicals: 2 hrs/Week Credits: 2	<b>Examination Scheme</b> External marks- 35 Internal marks- 15

### Course Objectives:

1. To give complete knowledge of qualitative analysis.
2. To describe functional groups in organic compounds.

### Detailed Syllabus

#### Sec A:

#### Qualitative analysis:

Using H<sub>2</sub>S /PTC/ Thioacetamide or any other reagent. Identification of cations and simple anions in a mixture of salts containing not more than six ions (Three cations and three anions)

interfering anions using semimicro scheme of analysis. If combination of cations or anions is given in the mixture, insoluble should be avoided. Spot tests should be carried out for final identifications wherever feasible.

**Cation :** Pb<sup>2+</sup>, Bi<sup>3+</sup>, Cu<sup>2+</sup>, Cd<sup>2+</sup>, As<sup>3+</sup>, Sb<sup>3+</sup>, Sn<sup>2+</sup> or Sn<sup>4+</sup>, Fe<sup>2+</sup> OR Fe<sup>3+</sup>, Al<sup>3+</sup>, Cr<sup>3+</sup>, Co<sup>2+</sup>, Ni<sup>2+</sup>, Zn<sup>2+</sup>, Mn<sup>2+</sup>, Ba<sup>2+</sup>, Sr<sup>2+</sup>, Ca<sup>2+</sup>, Mg<sup>2+</sup>, NH<sup>4+</sup>, K<sup>+</sup>

**Anion :** CO<sub>3</sub><sup>2-</sup>, SO<sub>3</sub><sup>2-</sup>, S<sup>2-</sup>, NO<sub>2</sub><sup>-</sup>, CH<sub>3</sub>COO<sup>-</sup>, NO<sub>3</sub><sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, I<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, PO<sub>4</sub><sup>3-</sup>, BO<sub>3</sub><sup>3-</sup>, F<sup>-</sup>.

#### Sec B:

1. Tests for following functional groups

2. Qualitative analysis of following types of unknown organic compounds

1. Carbohydrates
2. Primary, secondary and tertiary amines
3. Nitro compounds
4. Amides
5. Aryl halides
6. Hydrocarbons

Identification of the functional groups, C-C and C-N triple bonds,  $sp^3$ ,  $sp^2$  and  $sp$  hybridized C-H bonds by IR spectroscopy (IR spectra to be provided)

### **Course Outcomes:**

After completing the course, students will be able to:

1. Understand identification of the functional groups.
2. Identification of cations and simple anions in a mixture of salts

<b>`BHC652: Physical Chemistry &amp; Application of Computers in Chemistry Lab</b>	
<b>Teaching Scheme</b> Practicals: 2 hrs/Week Credits: 2	<b>Examination Scheme</b> External marks- 35 Internal marks- 15

### Course Objectives:

1. To give complete knowledge of colourimetry.
2. To describe word processing.
3. To explain molecular modeling.

### Detailed Syllabus

**Sec A:**

- Colourimetry
  - Verification of Lambert-Beer's Law
  - Determination of pK (indicator) for phenolphthalein or methyl red
  - Study the formation of a complex between ferric and thiocyanate (or salicylate) ions.
  - Study the kinetics of interaction of crystal violet with sodium hydroxide colourimetrically.
  - Record the U.V. spectrum of a given compound (acetone) in cyclohexane
- (a) Plot transmittance versus wavelength.
- (b) Plot absorbance versus wavelength.

**Sec B:**

**Word processing:**

Incorporating chemical structures into word processing documents, presentation graphics, on-line publication (www/html).

Handling numeric data: spreadsheet software (Excel), simple calculations, statistical analysis, plotting graphs using a spreadsheet, graphical solution of equations, solving equations numerically (e.g. pH of a weak acid ignoring/ not ignoring the ionization of water, volume of a van der Waals gas, equilibrium constant expressions).

Numeric modelling, numerical curve fitting, linear regression (rate constants from concentration-time data, molar extinction coefficients from absorbance data).

**Molecular modelling:**

Visualization of 3D structures, calculation of molecular structures and properties (e.g., conformational energies of butane).

Note: 1. Software: Microsoft Office, ChemOffice (Free alternatives: OpenOffice

([www.openoffice.org](http://www.openoffice.org)), ISIS Draw (<http://www.mdli.com>; registration required), ArgusLab

([www.planaria-software.com](http://www.planaria-software.com)).

2. References: Internet, documentation of software.

**Course Outcomes:**

After completing the course, students will be able to:

1. Understand various types molecular modeling.
2. Understand and verify Lambert-Beer's Law.
3. Evaluate incorporating chemical structures into word processing documents, presentation graphics and online publication.